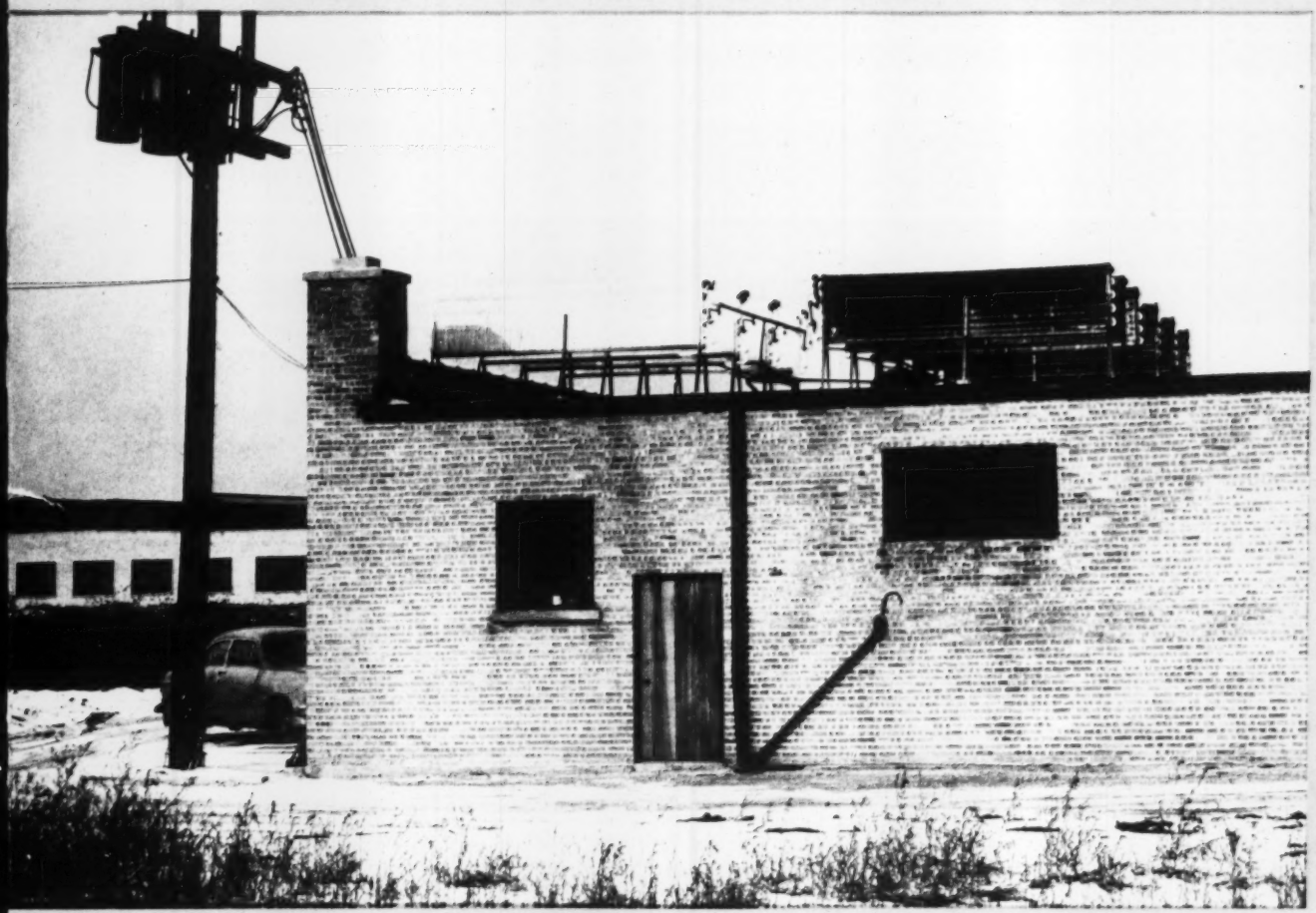
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

APRIL ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 121—Journal Section of The American Society of Heating and Ventilating Engineers



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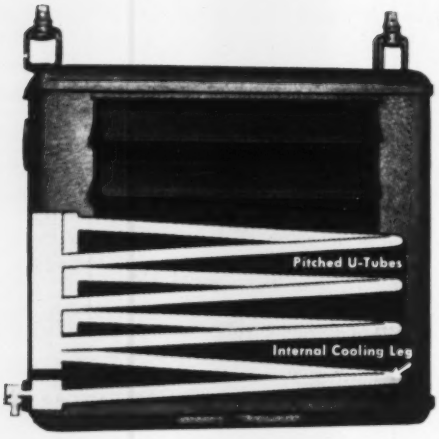
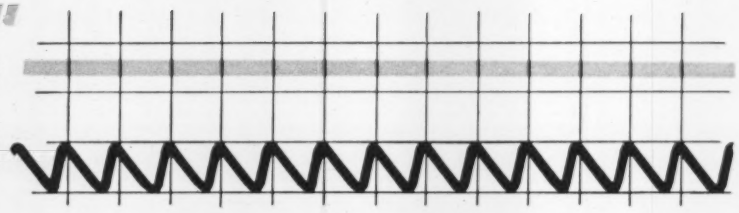


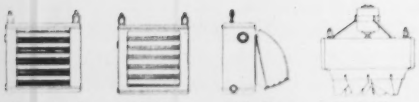
when buying unit heaters

be sure you get this

...not this!



With **THERMOLIER**...
the Grinnell Unit Heater . . . you get
CONTINUOUS RATED CAPACITY



THERMOLIER FEATURES

INTERNAL COOLING LEG A Grinnell feature which permits the use of a plain thermostatic trap for draining condensate.

PITCHED U-TUBES Built-in pitch of U-tubes provides complete drainage of condensate and elimination of destructive water hammer.

CONTINUOUS RATED CAPACITY The combination of Thermolier's internal cooling leg and the built-in pitch of tubes assures continuous rated capacity.

BUILT-IN EXPANSION PROVISIONS Every tube is an expansion bend of the U type to allow for independent expansion and contraction of each tube.

TUBE-TO-HEADER CONSTRUCTION Safety and durability assured by unique tube-to-header construction.

EASE OF ERECTION Exclusive with Thermolier are the adjustable swivel couplings which provide an easy, cost-saving method of hanging the unit.

SIMPLE PIPE CONNECTIONS The supply and return piping connections are on the same side to assure compactness, neatness and economy in installation.

MOTORS Thermolier motors are built specifically for unit heater duty. They give maximum operating efficiency with minimum power cost.

The practical advantages of unit heating, of course, are well known. But in order to get *maximum* economy and efficiency, certain engineering and structural features *must be* present in the unit heater of your choice.

Take provisions for draining off condensate. Failure to provide freedom from collected condensate in the heating element can interfere with heat output and adversely affect capacity.

A Thermolier Unit Heater successfully handles this drainage problem with its pitched U-tubes and internal cooling leg, through which all the condensate passes. In fact, condensate cooling is so efficient with Grinnell Thermoliers that a thermostatic trap — the simplest and least expensive of all traps — can be used with every model. Condensate temperature is lowered to the point where the trap is always draining — giving Thermolier Unit Heaters their *continuous rated capacity*.

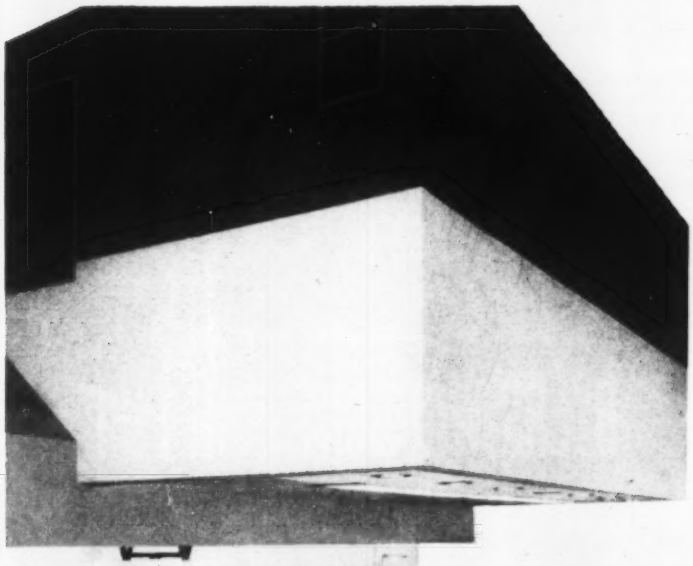
Check Thermolier's advantages at left. For more details, call your local Grinnell distributor — or send for catalog.

GRINNELL

THERMOLIER UNIT HEATERS

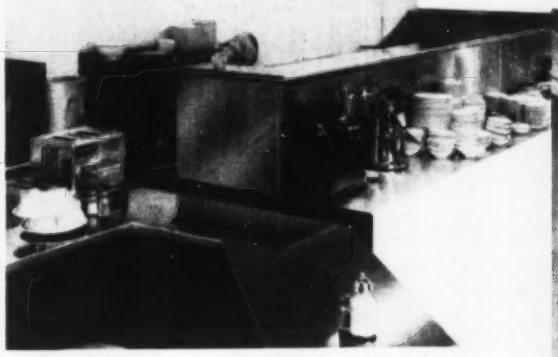
Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

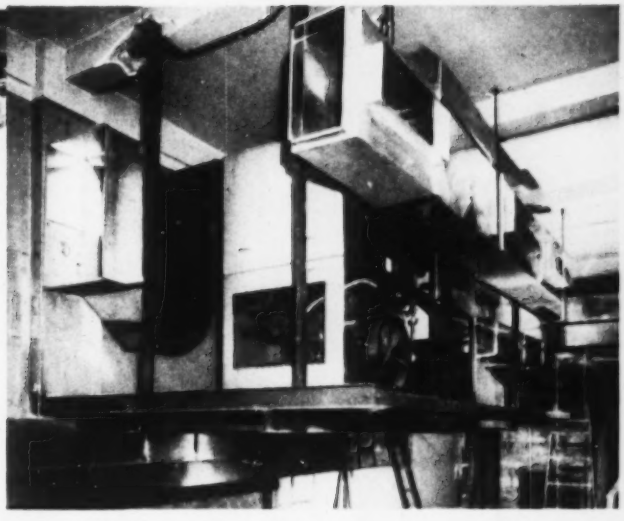
Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



New York Pharmacy Saves Floor Space

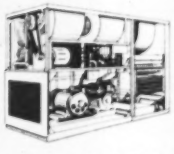
BY SUSPENDING AIR CONDITIONING SYSTEM FROM CEILING!





ABOVE: *Completed installation blends beautifully with all over architectural plan of Lewis Pharmacy.*

RIGHT: *Picture of installation in progress shows RK-15 unit suspended from ceiling, to be housed in steel framework.*



When Lewis Pharmacy, New York soda fountain-luncheonette, decided to install an air conditioning system, their major problem was lack of floor space. The problem was solved by the installation of a USAIRCO RK-15 (Refrigerated Kooler-aire, 15 H.P.). Instead of the conventional floor type installation, this central station package unit was suspended from the ceiling in a steel-framed enclosure above and behind the counter.

The enclosure is oversized to provide room for service and to accommodate an exhaust blower to remove cooking odors from below. The installation blends attractively with the interior decorating plan of the pharmacy. Imperial Equipment Corporation engineered and installed the system for the Lewis Pharmacy.

The USAIRCO RK-15 combines all the elements of space-consuming built-up systems into one neat package. Air conditioner, compressor and evaporative condenser are combined in this single operating unit. Delivered ready for immediate installation, only 3 connections are necessary: to ducts, water supply and drain, and power supply.

United States Air Conditioning Corporation manufactures RK in 10 various sizes, from 3 to 50 H.P. capacity, to fit any air conditioning requirement.

For Descriptive Literature on RKs Write Dept. HP43

UNITED STATES AIR CONDITIONING CORPORATION

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EVERYTHING IN AIR CONDITIONING

BYERS WROUGHT IRON PIPE
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Heating Piping & Air Conditioning

Vol. 25 No. 4

APRIL 1953

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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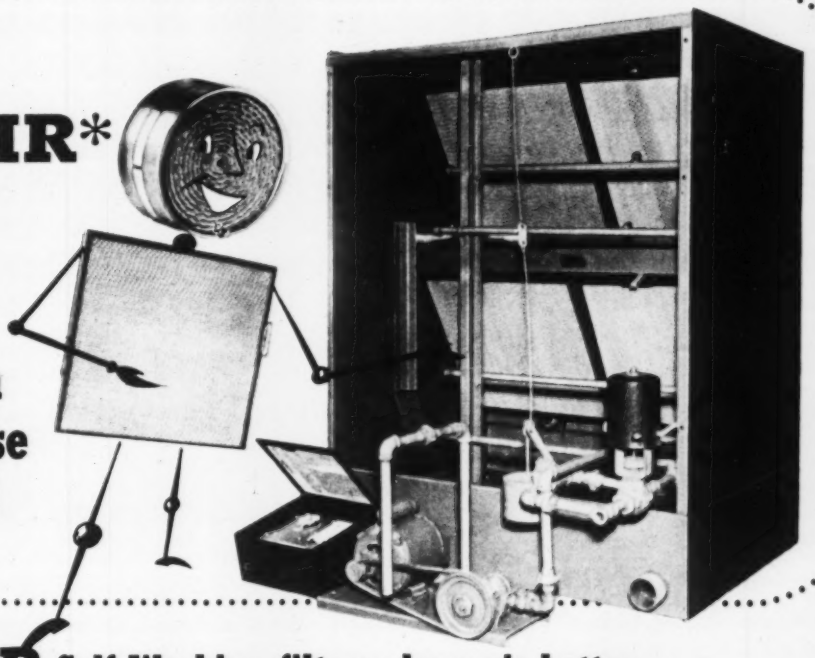

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Automatic fire control • Minimum maintenance
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Name _____ Title _____

Company _____

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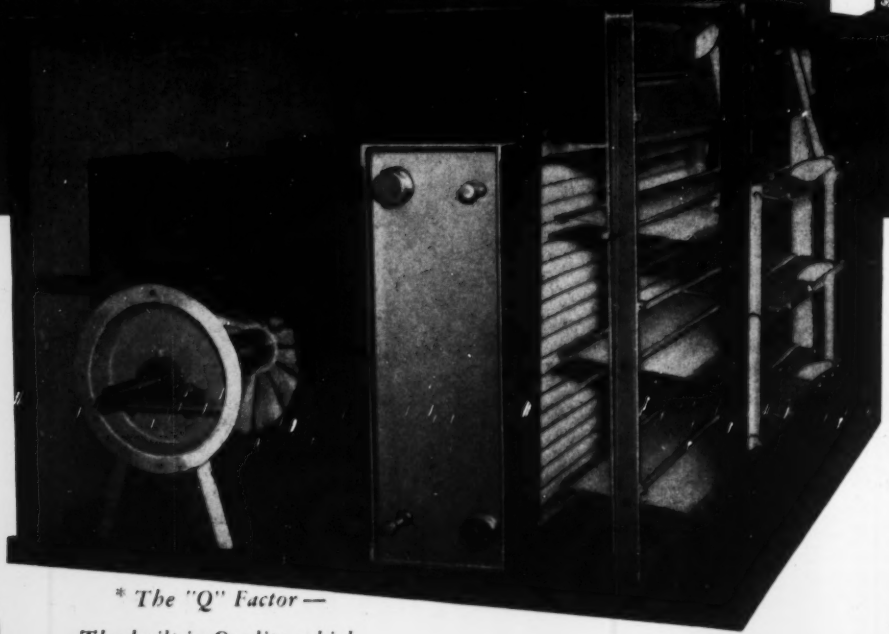

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The built-in Quality which provides trouble-free satisfaction and long life.

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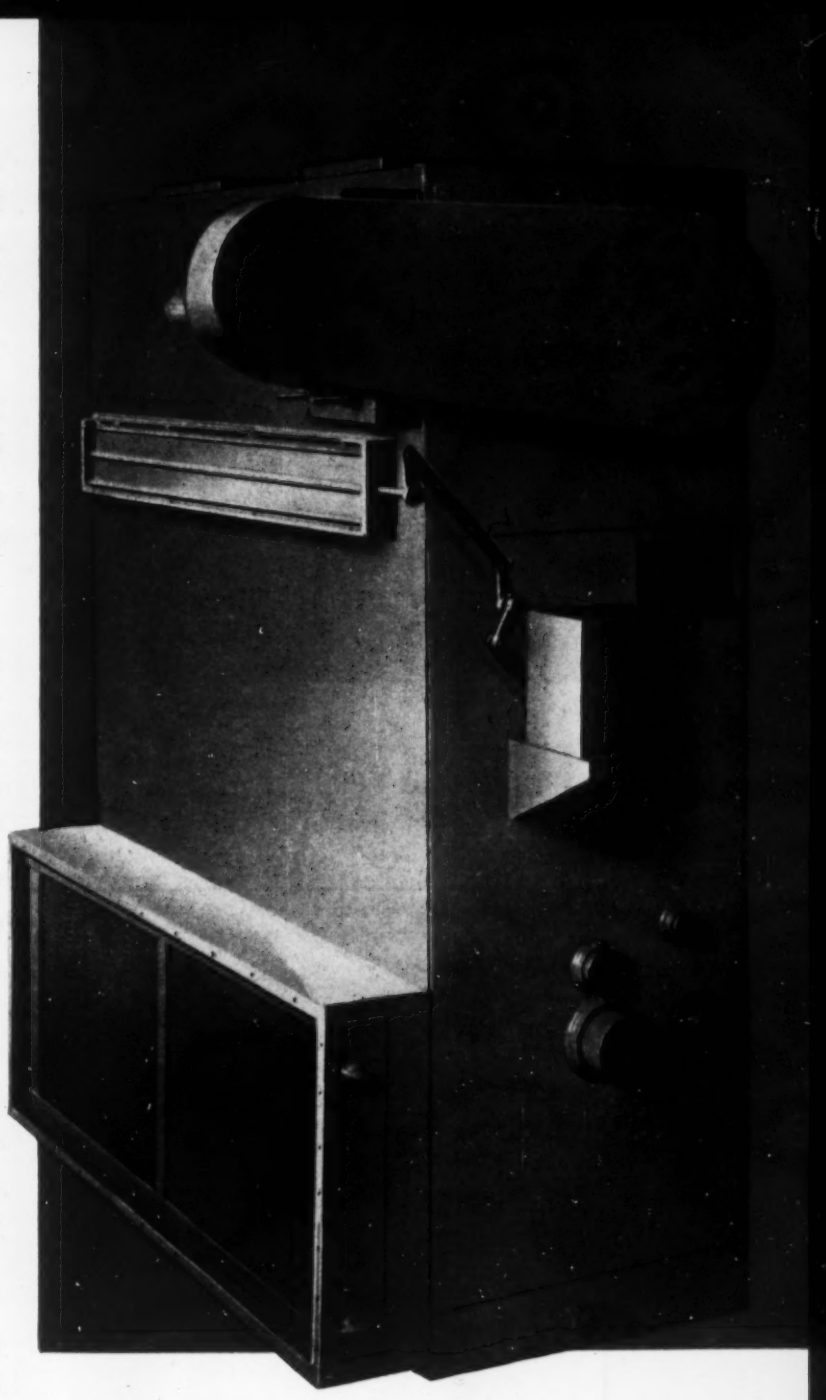

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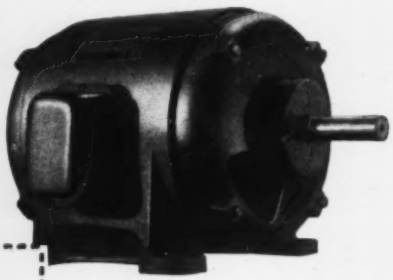

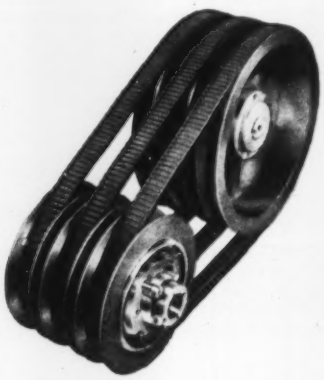

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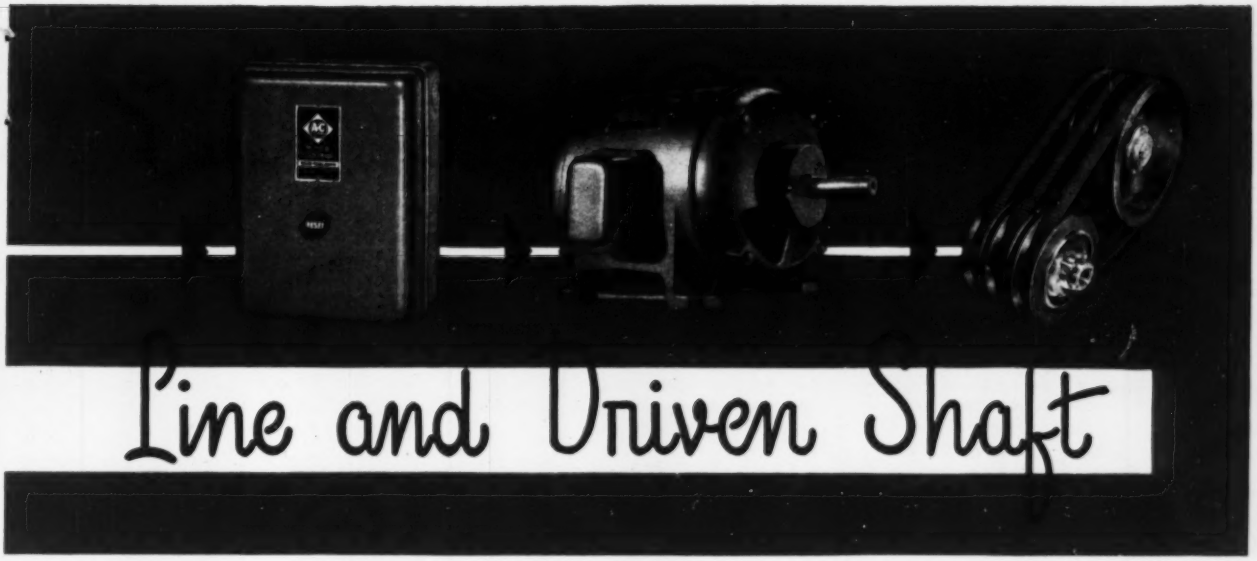
Constant speed sheaves include *Texsteel* sheaves and *Magic-Grip* easy mounting sheaves in a complete range of sizes.



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CAN HELP YOU

Control — There is an Allis-Chalmers control to meet every requirement of motor operation through the complete range of motor sizes. Manual and magnetic, reversing and non-reversing, across-the-line and reduced voltage starters are included. Push button and pilot devices are available in any number of positions and in all combinations. Accessory Allis-Chalmers control equipment includes dc contactors, timing relays, contactors for heavy duty starting and rotary control switches.

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Unit Responsibility

By using Allis-Chalmers coordinated drive components, you save paperwork and the time and cost of matching parts from different sources. More important, you know the components will fit together properly . . . that assembly will be completed quickly and easily.

And you don't have to worry about passing the buck on service. Allis-Chalmers stands behind the complete drive and takes responsibility for the proper functioning of every part.

Delivery from Stock

Immediate delivery from stock can be had on nearly all standard items from warehouses and distributor stocks located all over the country.

Allis-Chalmers representatives are experienced in air conditioning problems and can give you the kind of help you need in selecting the best drive for your machine. And this team of field experts is backed up by a large factory engineering staff.

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Allis-Chalmers continues to serve you after the sale with nearly a hundred Certified Service Shops located in every industrial area in the country. Allis-Chalmers Certified Service Shops are carefully selected independent service shops that use only factory-approved parts and methods in complete servicing of Allis-Chalmers equipment.

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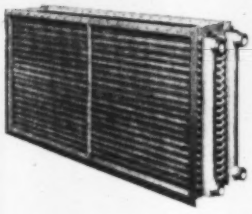
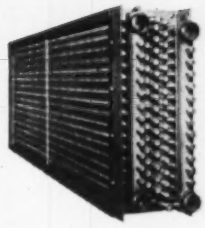


WATER COIL



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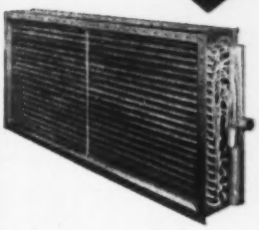

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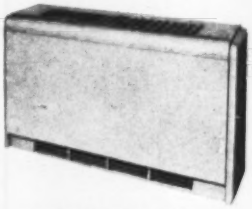
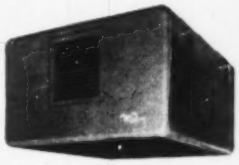
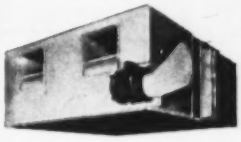
"BLAST" HEATING STEAM COIL



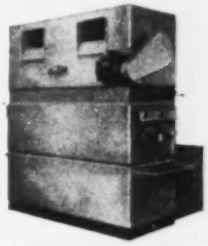
SEASONMAKER (FLOOR)



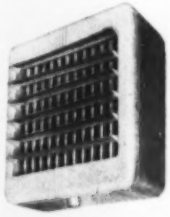
"RH" AIR CONDITIONER



AIR CONDITIONER
(Suspended Model)

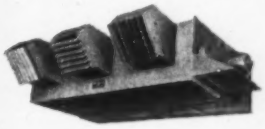


AIR CONDITIONER
(Floor Model)

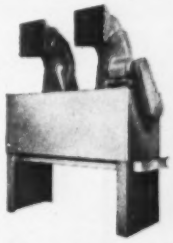


HORIZONTAL UNIT HEATER

DOWN FLOW UNIT HEATER

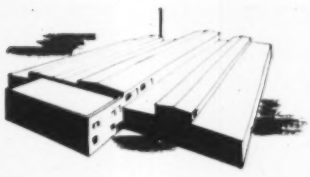


BLOWER TYPE UNIT HEATER
(Suspended Model)



BLOWER TYPE UNIT HEATER
(Floor Model)

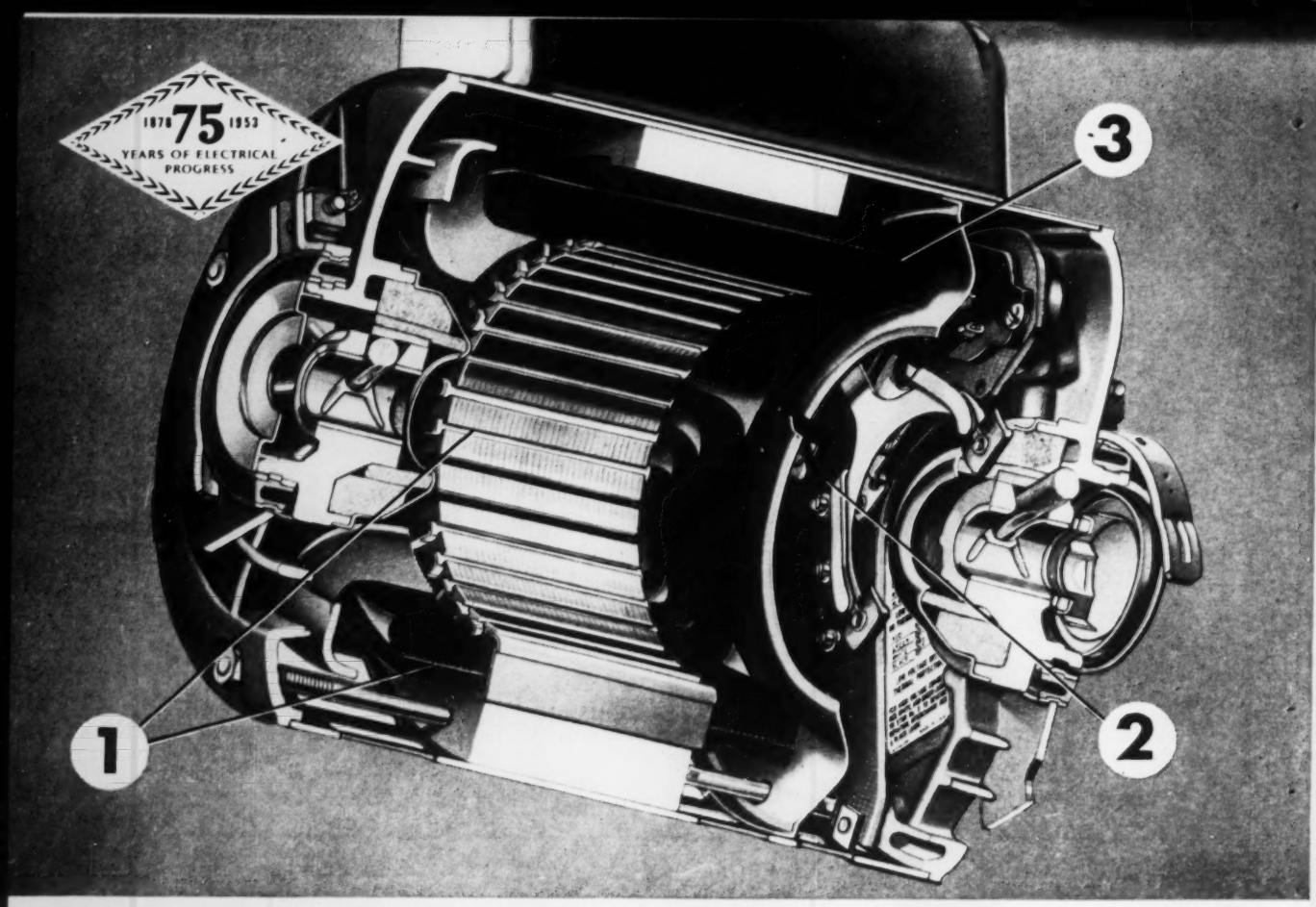
McQuay representatives, in all principal cities throughout the United States, are qualified by long experience and training to help you satisfy all of your air conditioning and heating requirements. For cooperation in making the sale, technical advice, or getting the job done on time, consult the McQuay representative in your territory. Available to you through him is the complete line of McQuay products, featuring famous Ripple-Fin construction—a McQuay exclusive, assuring maximum heat transfer efficiency and dependable performance.



PLANT 1—1600 Broadway N. E.
MINNEAPOLIS 13, MINN.

PLANT 2—1729 Broadway N. E.
MINNEAPOLIS 13, MINN.

PLANT 3—4th and Park Ave.
FARIBAULT, MINN.



G-E FHP MOTOR CUTAWAY—The numbers shown here are keyed to the insulating materials which enable this General Electric motor to effectively withstand the harmful effects of moisture, oils, mild acids and alkalies and the results of aging.

New G-E insulation system

. . . first use of "Mylar" in electric motors

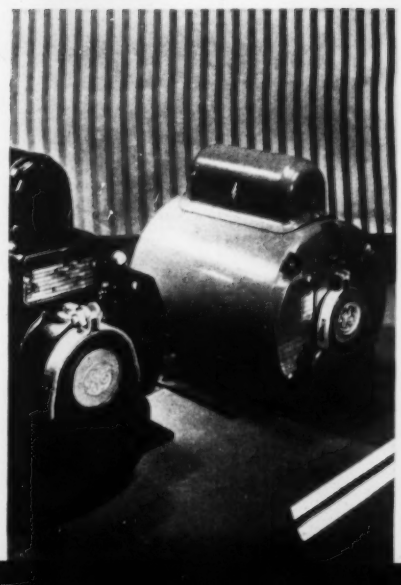
General Electric's new Fhp motor is the first to offer the superior insulation qualities of DuPont Company's "Mylar" Polyester Film. An insulator that raises the safety factor of everyday motor operation while contributing to greatly increased motor life through improved insulation. "Mylar" in combination with G.E.'s already proven Formex wire, braidless Neoprene leads and Glypta! varnish now offers you the most advanced type of motor insulation. An insulation system that means better motor protection . . . longer motor life even under abnormal conditions.

This new G-E Fhp general-purpose motor gives you full NEMA performance . . . reduces shipping and handling costs with up to 50% less weight and 40% less bulk. For complete information, contact your nearest G-E Apparatus Sales Office or write Section 702-1 for Bulletin GEA-5567, General Electric Co., Schenectady 5, N. Y.

*DuPont trade mark

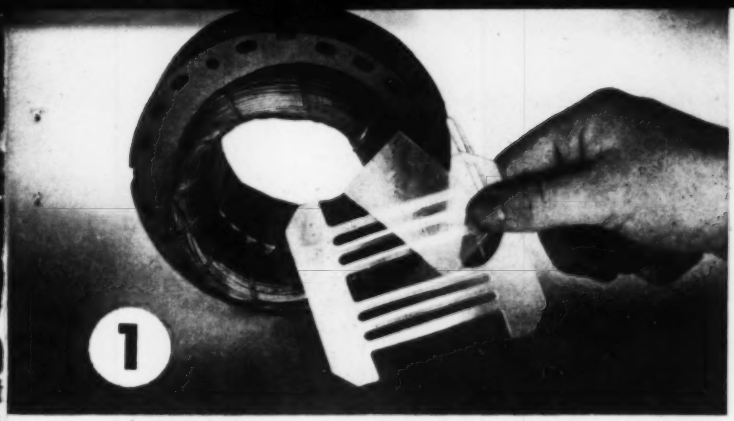
**Reg. trade-mark of the General Electric Co.

SMALLER . . .



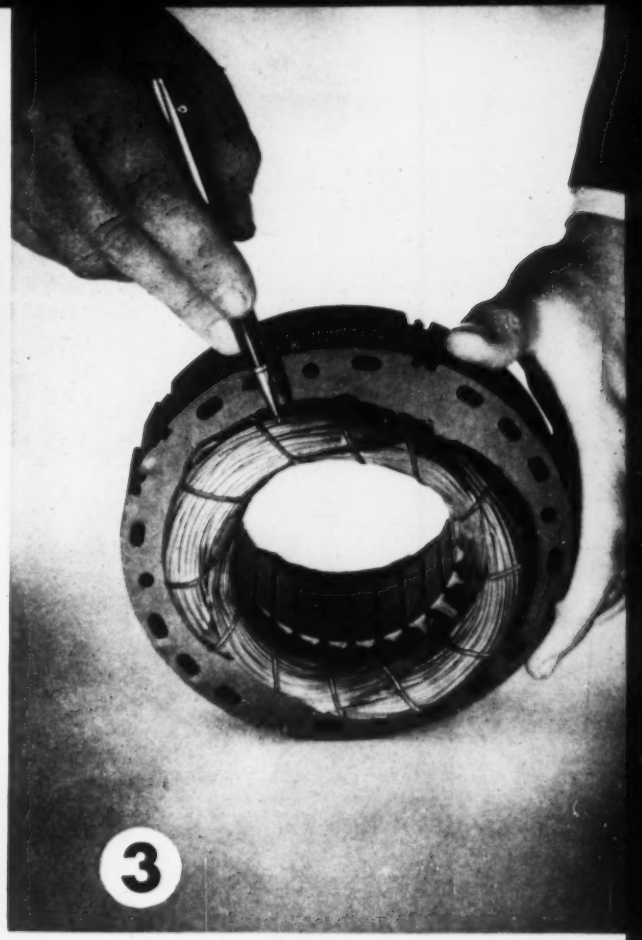
You can put your confidence in—

GENERAL ELECTRIC



"MYLAR"* POLYESTER FILM with extremely high dielectric strength now used for the first time in all slot, phase, and wedge insulation.

BRAIDLESS NEOPRENE LEADS of clear and permanent color retain high insulation strength and flexibility under severe operating conditions.

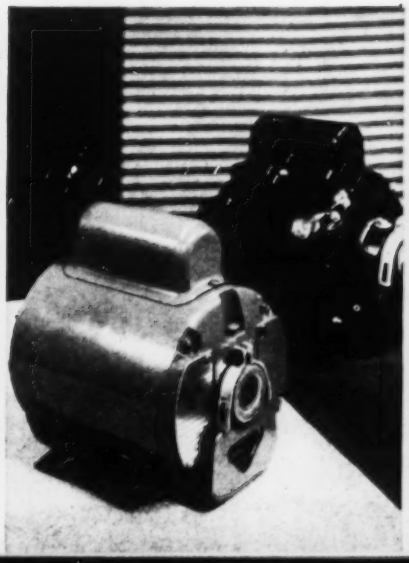


FORMEX WIRE PLUS GLYPTAL**** stator coating balance physical and electrical properties for top protection.

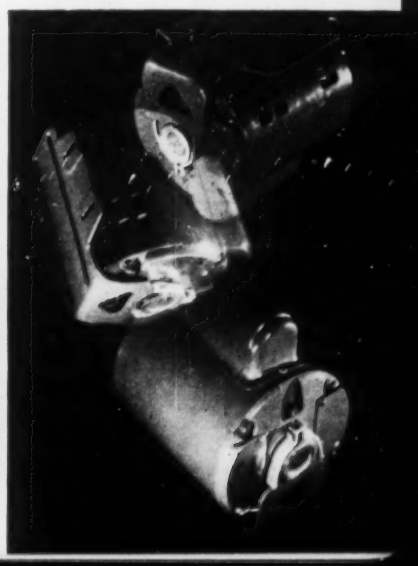
lengthens fhp motor life!

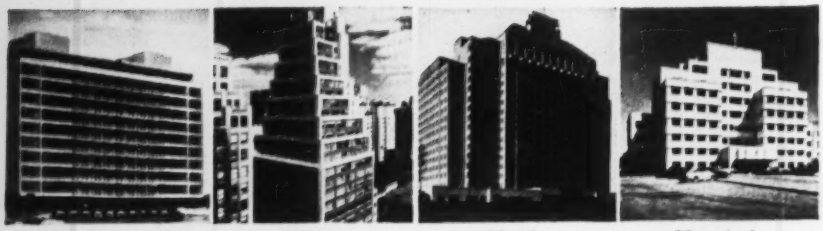
LIGHTER . . .

BETTER LOOKING . . .



MORE VERSATILE!





Apartments *Offices* *Hotels* *Hospitals*

No building too

ductless UniTrane

ACCURATELY RATED AND TESTED

Every UniTrane unit is carefully designed, manufactured and tested to conform with published TRANE capacity ratings. Units require no maintenance other than semi-annual check-ups of oil cups and filters. Sturdy, die-formed steel cabinets are designed to withstand years of service.

for individual room control of

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR

large...few too small for

room-controlled air conditioning

Provides advantages of central system plus best features of the unit system!

It's different! The UniTrane System of air conditioning offers advantages of a central system PLUS quiet, compressor-free room units that cool or heat, dehumidify, ventilate, filter and circulate the air . . . and all this without the use of central system ducts!

Each tenant is boss—Because UniTrane provides individual room control, it meets widely varied demands in large office buildings, hospitals, hotels and commercial buildings down to small apartments and motels. Each tenant sets the temperature and ventilation of his room just as *he* wants it, without affecting any other room.

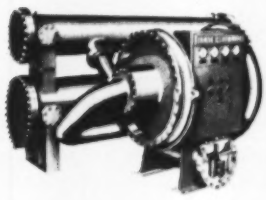
Big space saver—UniTrane saves space in many ways. Its single piping circuit handles chilled water in summer, hot water in winter. Ventilation air is introduced directly through the wall into the individual room units. The compact room units are only 25-inches high . . . can be recessed under windows. Large equipment rooms and accompanying ductwork are eliminated.

Accurate design data—Designing a UniTrane System is essentially a matter of selecting accurately rated units for the various rooms and zones. No multi-room buildings are too large to permit UniTrane air conditioning in each individual room.

Simple and flexible—UniTrane is nearly as simple to install and operate as is a standard heating system. It can easily be extended to new building additions. You can shift units or add units to meet changing requirements. You can install UniTranes for heating only and add central water chilling equipment later. You can shut off rooms and sections not being used. Even partially finished or partially occupied buildings can have complete room-controlled air conditioning with UniTrane.

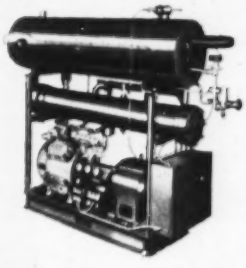
For complete information, contact your Trane Sales Office or write The Trane Company, LaCrosse, Wisconsin, for Bulletin DS 420.

For over 50-room UniTrane installations . . .



CENTRAVAC A complete centrifugal water chilling system, hermetically sealed. Five models from 45 to 200 tons. Automatic throttling controls permit efficient operation down to 10% capacity. Power consumption closely proportionate to load through entire range.

For 10 to 50-room UniTrane installations . . .

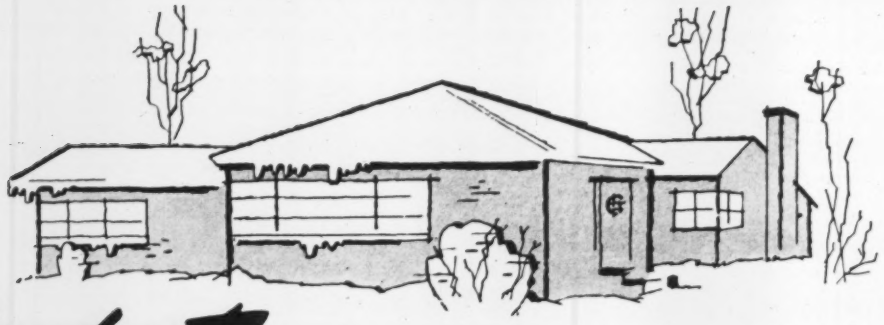


COLD-GENERATOR This unit delivers chilled water from one compact package . . . brings you a complete refrigeration cycle, factory engineered, factory assembled, factory tested, factory guaranteed! Only simple plumbing and electrical connections needed to install.

TEMPERATURE
HUMIDITY
VENTILATION

TRANE UniTrane

CONDITIONING EQUIPMENT The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices

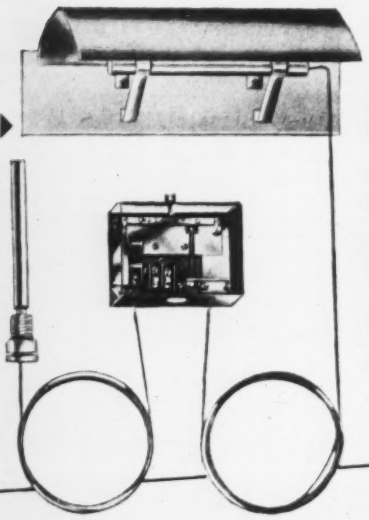


Comfort...always comfort!

with SARCOTHERM

COMPENSATING OUTDOOR CONTROL

for hot water, radiant or warm air heating systems.



SARCOTHERM COMPENSATING INDOOR-OUTDOOR CONTROL, TYPE AO-1

Temperature is automatically reset by outdoor temperature changes so as to maintain comfort inside. (Not suitable where domestic hot water is taken from the same heating source.)

Schematic diagram showing simple hook-up for hot water, radiant heat or warm air heating systems.

Sarcotherm Engineers are always glad to help with installation data.

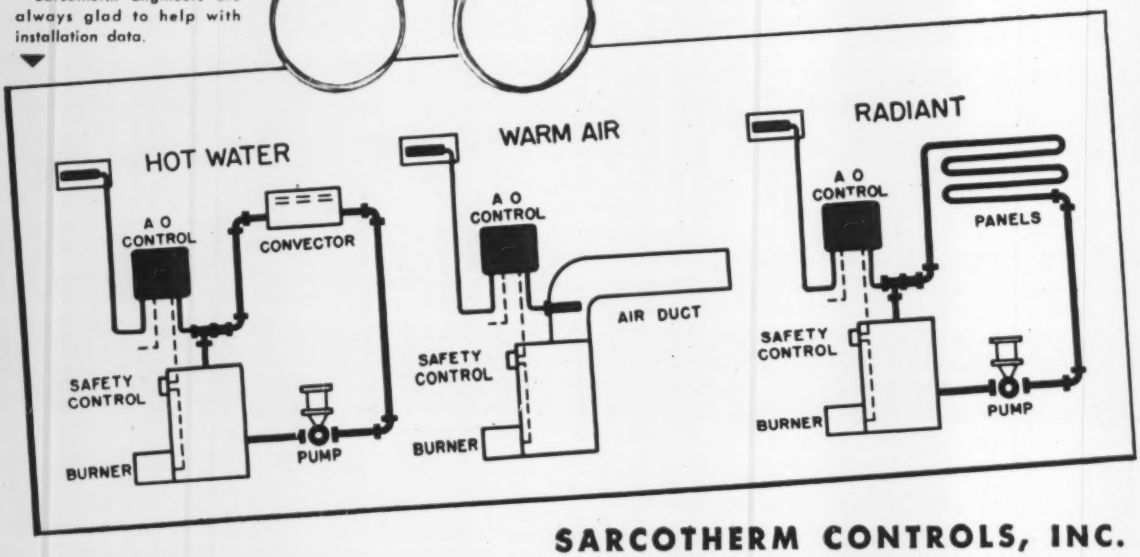
HERE is the ideal automatic temperature control for homes heated by hot water, radiant heat or hot air.

It automatically varies the circulating water (or air) temperature in accordance with outdoor temperature changes.

It can be easily adjusted for any desired control setting and will maintain comfort temperatures desired inside, regardless of the weather.

For low cost, accuracy of control and simplicity of installation, Sarcotherm type AO-1 is without equal.

Complete engineering information in Bulletin ST 600, free on request.



SARCOTHERM CONTROLS, INC.

Complete Line of Temperature Controls for Heating

EMPIRE STATE BUILDING • NEW YORK 1, N. Y.

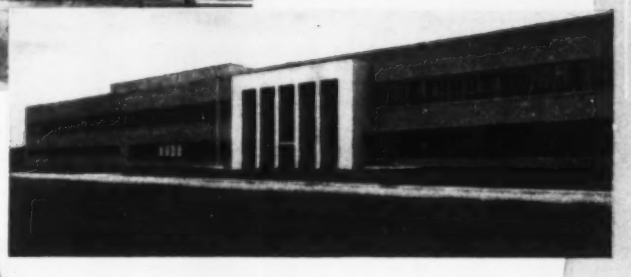
Branches in principal cities—Factory at Bethlehem, Pa.

26

A SARCO PRODUCT

THE LEADERS OF INDUSTRY

Ford Motor Co. new foundry and engine plant at Cleveland, Ohio.



...use SARCO heating specialties

WHEN large industrial projects are planned, leading architects and engineers design the buildings and select the equipment, and many top executives must approve the specifications.

Sarco is proud to be listed in so many of these top rank industrial specifications, covering steam traps of several types, radiator valves and strainers for space heating and air conditioning as well as temperature contrc!s for process work and hot water supply.

For example, at Ford Motor Company's new plants in Cleveland, Sarco Specialtie: are installed throughout.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ont.

Sarco Type H Radiator Trap

Sarco No. 1141 Radiator Valve

Sarco Type FT Float-Thermostatic Trap

Sarco Type BMS Inverted Bucket Trap

Sarco Pipe Line Strainer

Sarco Type 24-30 Temperature Regulator

406

A FEW OF THE WORLD LEADERS WHO USE SARCO PRODUCTS IN THEIR NEW PROJECTS ARE:

U.S. STEEL CO.	Sarco	✓
WESTERN ELECTRIC CO.	Sarco	✓
FORD MOTOR CO.	Sarco	✓
BETHLEHEM STEEL CORP.	Sarco	✓
PRATT & WHITNEY AIRCRAFT	Sarco	✓
ALUMINUM CO. OF AMERICA	Sarco	✓

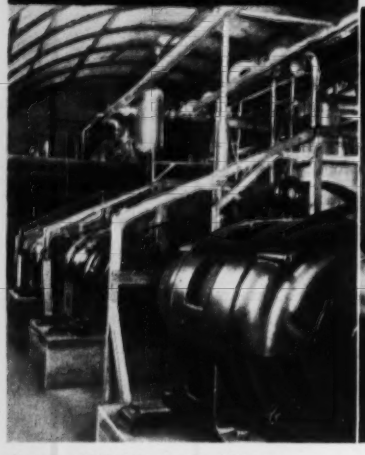
SARCO saves steam

sarco quality assures satisfaction

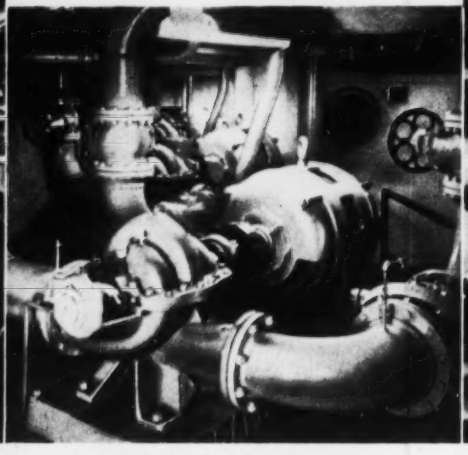
Large or Small...

Century MOTORS

Are Designed to Provide All the Performance That Is Built Into the Machines They Drive



Century 125 H.P. motors driving ammonia compressors for ice for the Falcon Dam, which is under construction on the Rio Grande River.



Century 125 H.P. motors on circulating pumps for condensing units. They serve the refrigeration system of a large department store.

Century 125 H.P. motors on circulating pumps for chilled water. Used in the same department store.

Here are some typical examples of equipment powered by large Century motors, which were application engineered for TOP PERFORMANCE.

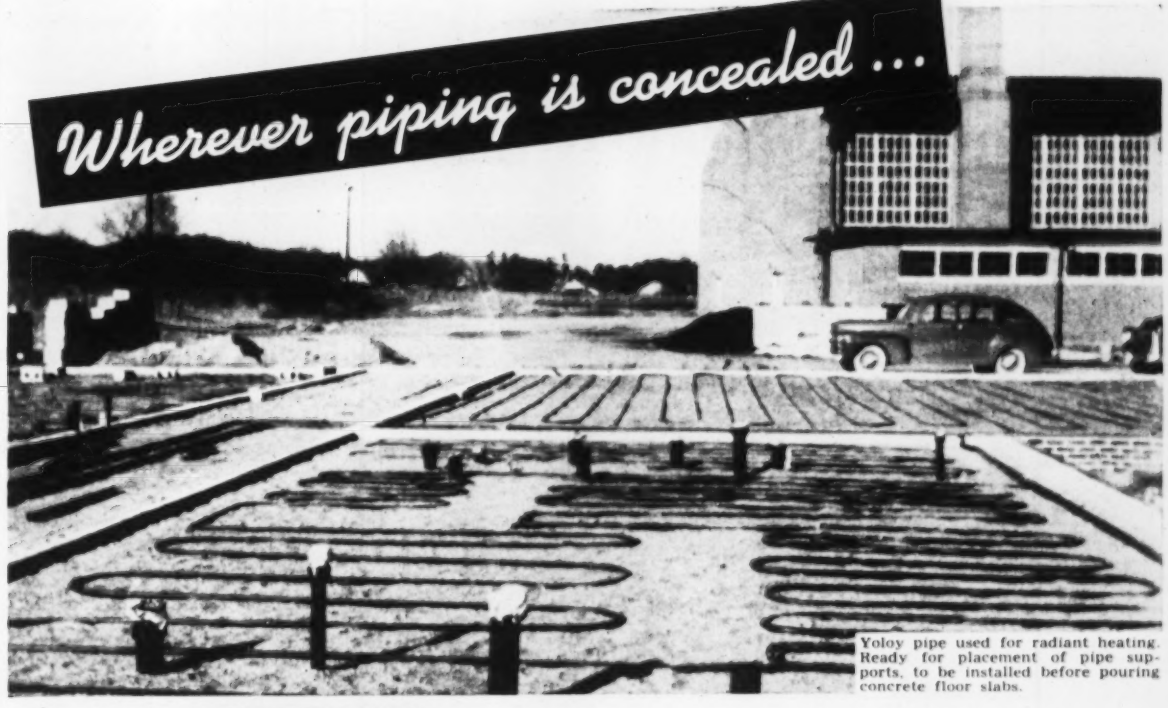
Matching the operating characteristics of your equipment is made easy through Century's wide line of single phase, polyphase and direct current motors to choose from. They are made in many types, ranging in size from 1/8 to 400 horsepower, with literally hundreds of specifications adaptable to specific applications.

Get Top Performance of your equipment through skillful motor application by specifying Century motors on the equipment you buy and for replacement.

CE780

CENTURY ELECTRIC CO.
1806 Pine St., St. Louis 3, Missouri
Offices and Stock Points in Principal Cities

Wherever piping is concealed . . .



Yoloy pipe used for radiant heating. Ready for placement of pipe supports, to be installed before pouring concrete floor slabs.

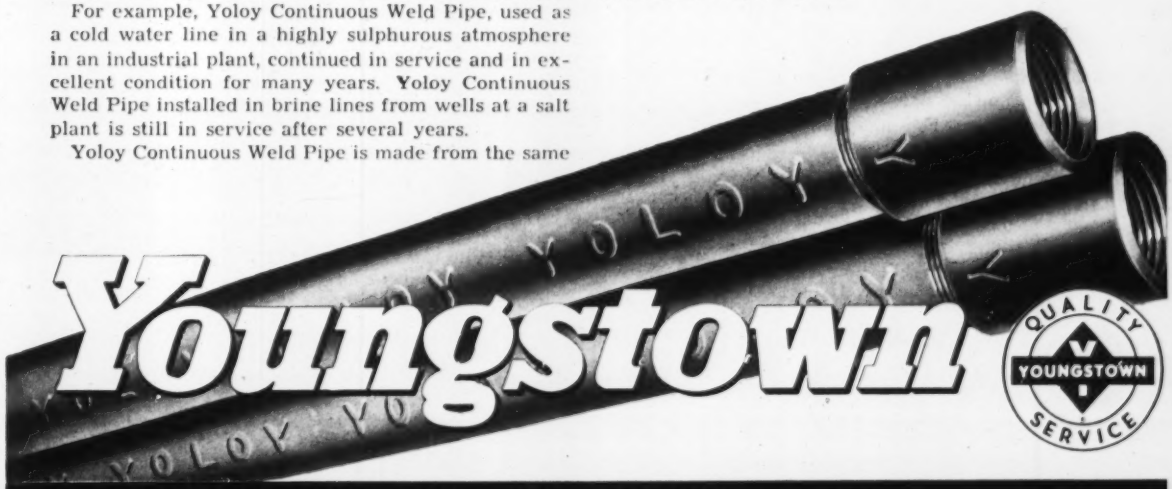
use YOLOY *continuous weld pipe*

Yoloy Continuous Weld Pipe offers distinct advantages for radiant heating and snow removal. Its use is recommended whenever piping is concealed—in industrial plants, commercial buildings, hospitals, schools and residences.

In standard tests Yoloy steel has demonstrated that its resistance to atmospheric corrosion is four to six times greater than that of regular steels. In actual installations Yoloy Pipe has demonstrated that it has a high resistance to many other corrosive conditions.

For example, Yoloy Continuous Weld Pipe, used as a cold water line in a highly sulphurous atmosphere in an industrial plant, continued in service and in excellent condition for many years. Yoloy Continuous Weld Pipe installed in brine lines from wells at a salt plant is still in service after several years.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in service in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. This pipe is easy to thread and fabricate with standard pipe tools. It can be electric or gas welded readily. It has high strength and high resistance to abrasion, shock and vibration fatigue. For further information, write or phone the Youngstown District Sales Office nearest you.



Youngstown

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

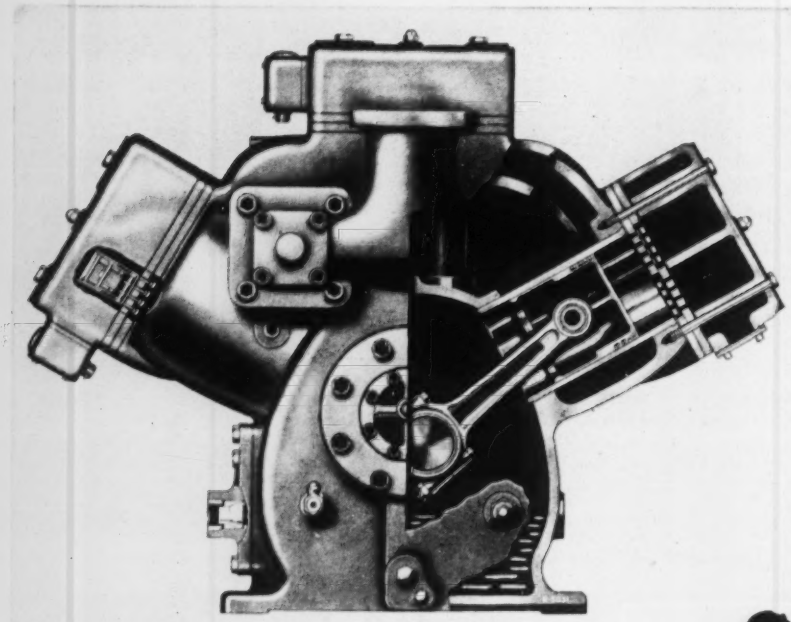
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES

Optimum-speed Freon compressor has high capacity plus long life!



New Worthington unit combines advantages of low and high speed

CUTAWAY VIEW of the new Worthington "J" compressor—the product of years of engineering research. Maximum capacity, with no loss in operating efficiency, is yours with this lighter-weight, optimum speed machine.

The problem was to design a compressor that would combine the advantages of *low*- and *high*-speed operation. Worthington's answer: the new, *optimum*-speed "J" compressor—a compact, high-capacity machine with the same high operating efficiency and life expectancy as its lower speed predecessors.

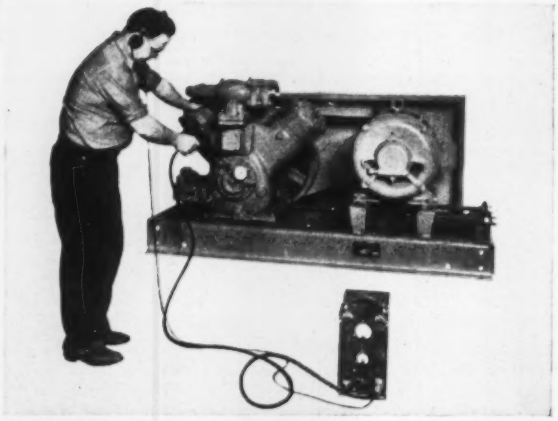
Here are just three of the many advancements in functional design that make the Worthington "J" line of compressors the finest available today.

1. ELECTRIC UNLOADING—a new achievement in variable capacity control. You can start compressor unloaded with a normal torque motor; power consumption is automatically balanced with load requirements. Separate unloader units in cylinder head allow easy maintenance . . . no complicated oil or gas pressure lines to worry about.

2. IMPROVED INTERNAL MANIFOLDING—cool suction gas completely surrounds the cylinder walls, providing longer valve life and increased overall efficiency. All passageways between suction discharge and shutoff valves are cast integrally within the crankcase, eliminating outboard fittings.

3. NEW FORCE-FEED LUBRICATION SYSTEM—full pressure, positive lubrication, regardless of rotation. A new rotary oil pump, driven directly by the crankshaft, eliminates complicated and noisy gear trains. Pump filters oil through a strainer in the crankcase.

Available in sizes of 3 to 150 tons, the new "J" compressors can be supplied with a horizontal shell and tube condenser, or they may be used with the Worthington Evaporative Condenser. Get in touch with your nearest Worthington district office, or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Holyoke, Mass.



THIS ELECTRONIC LEAK DETECTION TEST is part of the rigid testing that every Worthington compressor goes through before leaving the factory. Pressure tests, underwater tests and vacuum tests make sure that every unit will give long, trouble-free service.

From the most complete line . . . comes the correct recommendation

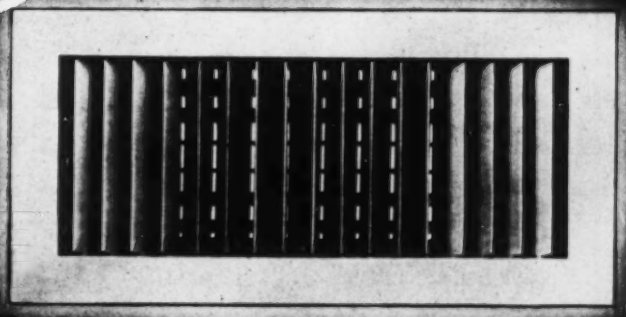
WORTHINGTON

Air Conditioning and Refrigeration

A.3.3

NEW ... with OPPOSED BLADE DAMPERS

SERIES 277



4-WAY Air-foil REGISTER

Series 277 combines 4-way directional grille with opposed blade damper. This provides both maximum directional control and positive volume control. Opposed blade dampers supply uniform distribution of air over entire grille face.

LATEST AND FINEST PRODUCT OF TITUS ENGINEERING. It stands out... by any comparison ... in its *beauty, rugged design... superior diffusion performance.*

FRAMES ... Heavy gauge cold-rolled steel. One piece.

BORDER ... 1¼" beveled edge.

LOUVERS ... Streamlined. Smooth as glass. Solid section.

LOUVER DEPTH ... ¾". Assures positive air deflection.

SCREW HOLES ... Countersunk for No. 6 screws. Spaced ½" on center from outer edge of border.

FINISH ... Gray lacquer primer as standard. Other finishes available at slight extra cost.

GASKET ... ¼" sponge rubber.

ADJUSTMENT ... Individual louver adjustment for front and center set of louvers. Opposed acting damper blades in rear are key operated.

• BRAND NEW 1953 CATALOG. Simplifies specifying. Provides all engineering data you need.

REQUEST YOUR FREE COPY NOW, including all specification and engineering data plus facts on construction, performance and selection of outlets.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

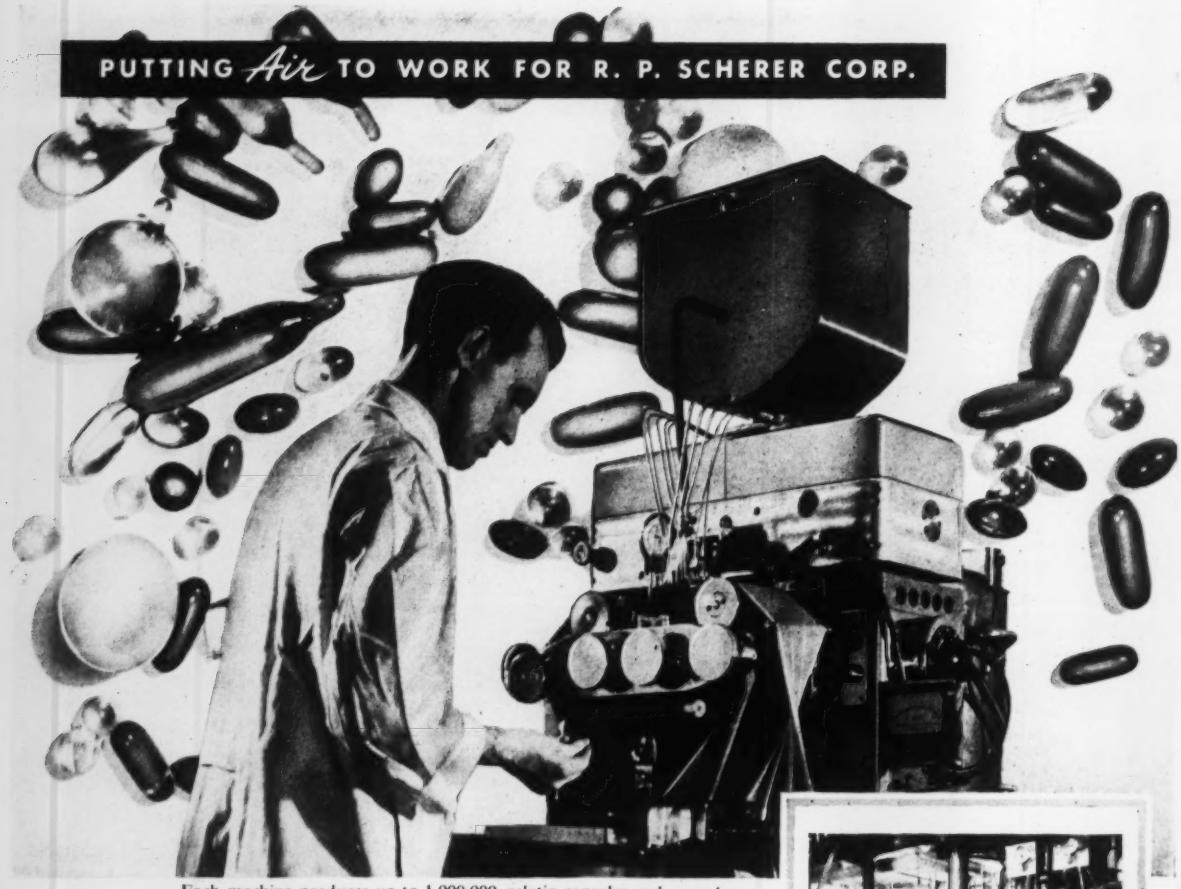
- ☐ RUSH information on Series 277.
- ☐ Send complete New 1953 catalog.
- ☐ Send literature on above checked items.

NAME_____

ADDRESS_____

CITY_____ STATE_____

PUTTING *Air* TO WORK FOR R. P. SCHERER CORP.



Each machine produces up to 1,000,000 gelatin capsules a day, and controlled atmosphere is a "must" to assure dependable production schedules.

KEEPING CAPSULES IN CADENCE FOR 9 TROUBLE-FREE YEARS

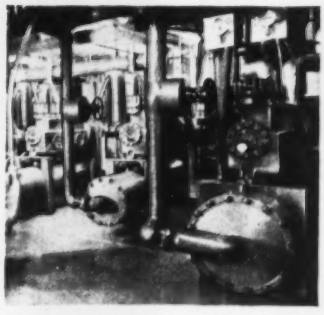
Capsules . . . capsules . . . capsules—name your size, shape and color! They turn out millions a day filled with anything from vitamins and medicine to lighter fluid and insecticide here at R. P. Scherer Corp. in Detroit. But watch out for moisture-laden air. Until they're dried, these soft gelatin containers are regular little water magnets.

The answer? Rigid, unvarying control of temperature and humidity 24 hours a day, seven days a week! It takes really dependable equipment for these unusual requirements. That's why Westinghouse Air Conditioning was selected.*

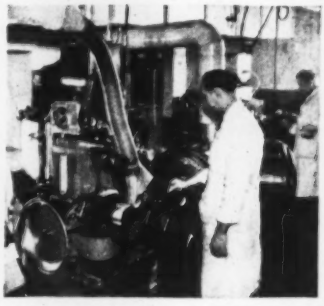
The result? For nine years their Westinghouse system has operated continuously without a single shutdown caused by mechanical failure. This full-time service equals *forty years* of normal service on an equivalent comfort air conditioning system.

Whatever your process involves in the way of a controlled climate, we can help you *put air to work* with air conditioning, air cleaning and air handling equipment. Call the Westinghouse Air Conditioning Distributor listed in the Yellow Pages, or write to Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.

*Installed by Mechanical Heat & Cold, Inc., Detroit, Michigan



Heads, end bells and side plates have not once been removed since installation in 1942 despite a continuous service record totalling 54,000 hours.



Controlled air supplied to each capsulating machine insures the absolute uniformity of product that is required.

YOU CAN BE SURE...IF IT'S

Westinghouse

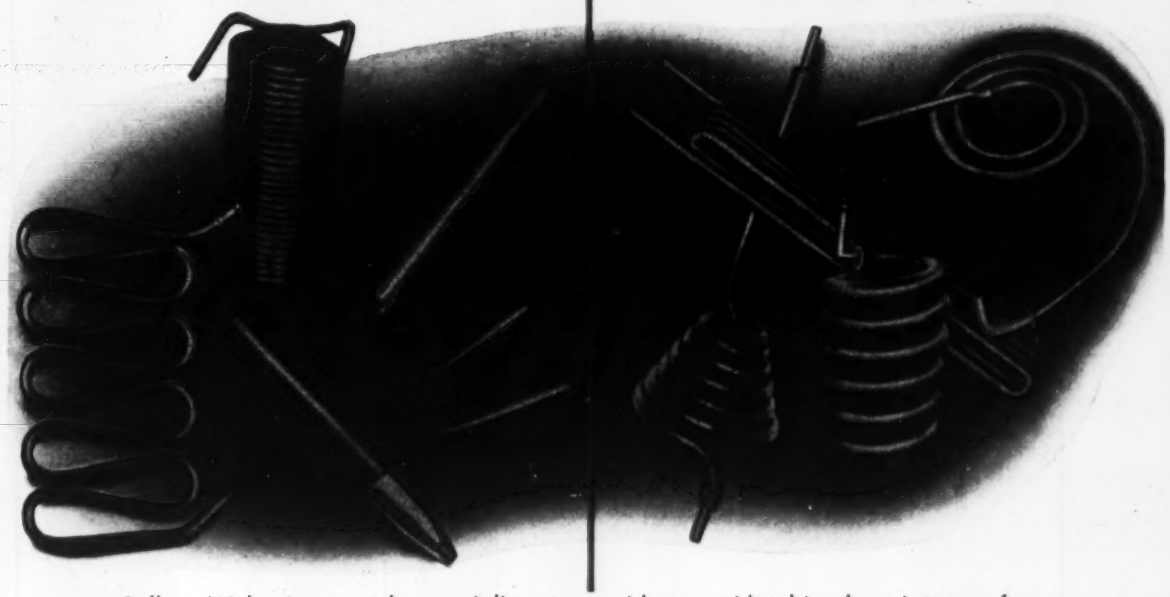
AIR CONDITIONING

J-80253

WOLVERINE will supply you with nonferrous tube fabricated in a variety of forms

Like this . . .
IN PLAIN TUBE

Like this . . .
IN FINNED TUBE



Call on Wolverine, as tube specialists, to provide you with tubing bent into any form that will best meet your particular requirements. Illustrated above are only a few typical forms.

Whether you require a simple bend, a closely wound coil or a more complex one — whether in plain tube or in the unique Wolverine Trufin* (the integral finned tube), it can be provided by Wolverine to your complete satisfaction.

Think of Wolverine first when you think of tube in any form — straight lengths or fabricated. Our Customer Engineering Service will be glad to help you in selecting the proper tube and tubular form. Send for our booklet, Fabricated Tubular Parts.

*REG. U. S. PAT. OFF.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

WOLVERINE TUBE DIVISION
of CALUMET & HECLA, INC.
Manufacturers of Tubing Exclusively
1419 CENTRAL AVENUE • DETROIT 9, MICHIGAN
Plants in Detroit, Mich. & Decatur, Ala. *Sales offices in Principal Cities*

ESTABLISHED 1916

Other Wolverine Products

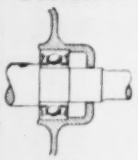
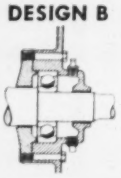
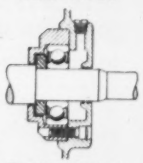
CAPILATOR*
—the capillary tube for restriction purposes
COMMERCIAL TUBE
AUTOMOTIVE TUBE
CONDENSER TUBE
COPPER WATER TUBE (K-L-M)
ELECTRIC WELDED STEEL TUBE
FABRICATED TUBULAR PARTS
WOLVERINE TRUFIN*
—the integral finned tube
REFRIGERATION AND AIR CONDITIONING TUBE
(Plain or Tin Plated)
S.P.S. PIPE
SPUN END TUBE†

*Reg. U.S. Pat. Off.
†A Patented Process RE 22465

Export Department, 13 E. 40th St., New York 16, N. Y.

"All motors are NOT alike!"

Check these ✓ 15 Reasons Why the RELIANCE Bearing Design is *the BEST one!*

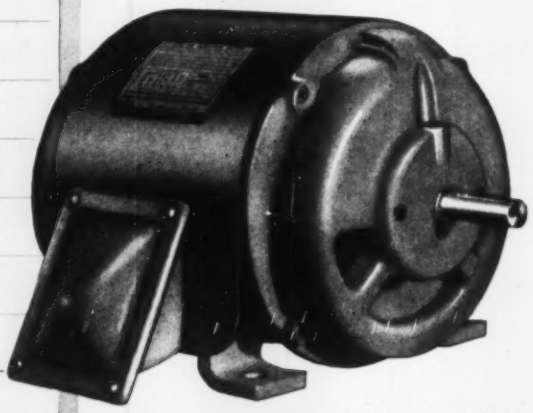
ONLY ONE MOTOR HAS ALL THESE DESIGN FEATURES:	DESIGN A  Prelubricated cartridge—bearing mounted in bracket	DESIGN B  Open bearing mounted in bracket	RELIANCE  Double-shielded, prelubricated bearing mounted in bearing cap
Bearing sealed from dirt and other foreign material	YES	NO	YES
Enclosed bearing housing	NO	YES	YES
Bearing can be relubricated without being disassembled	NO	YES	YES
Motor can be regreased without removing drain plug	**	NO	YES
Automatic grease relief to suit any lubrication system	NO	NO	YES
Protection against grease entering windings	YES	*YES	YES
Balls free of direct pressure during lubrication	YES	NO	YES
Bearing can be removed without danger of distortion	NO	NO	YES
Reservoir to protect against undergreasing	NO	YES	YES
Standard commercial ball bearings	YES	YES	YES
Larger grease reserve than provided with any standard bearing	NO	YES	YES
Grease supply free of churning action	NO	NO	YES
Measuring unnecessary to prevent overgreasing	NO	*YES	YES
Unnecessary to grease equally at each side of ball race	NO	YES	YES
Lubricant is retained in ball race	YES	NO	YES

** Means is not provided for relubrication of assembled motor.
*YES, if drain plug is removed.

The Reliance Pre-lubricated Bearing Design has all of the features vital to maximum motor life. Check these points in the chart at left. The performance of Reliance PRECISION-BUILT Motors in all industries and under all operating conditions has proved their value in long-wearing, trouble-free bearing design.

In most applications, Reliance PRECISION-BUILT Motors operate satisfactorily for years without relubrication. Where it is a practice to grease regularly or where operating conditions make it desirable . . . it is impossible to overgrease a Reliance Motor. Write for *new* Bulletin B-2201 for the "inside story" of the Reliance Pre-lubricated Bearing Design.

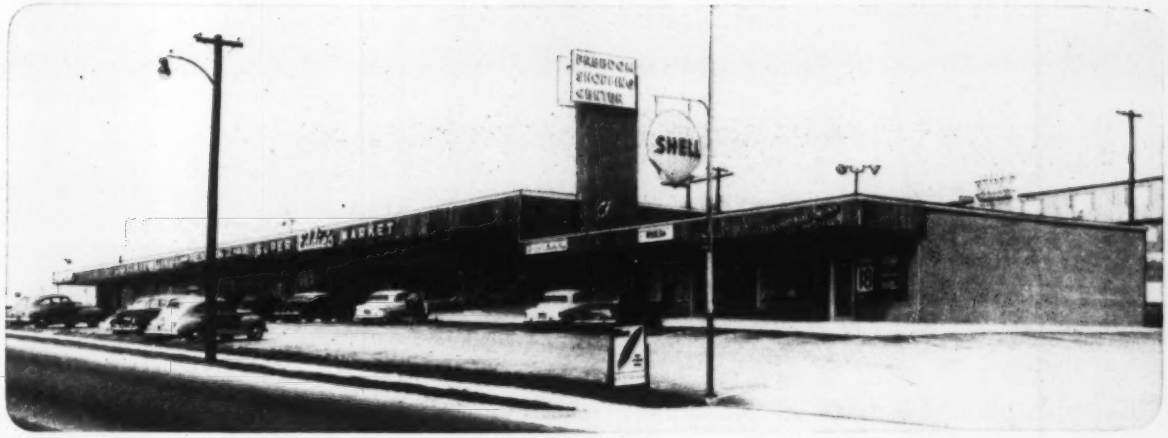
Reliance PRECISION-BUILT A-c. Motors from ¾ to 300 Hp.



Sales Representatives in Principal Cities

RELIANCE ELECTRIC AND ENGINEERING CO.

"All Motors are NOT Alike" • 1052 Ivanhoe Road, Cleveland 10, Ohio



NEW SHOPPING CENTER USES

Frick Unit Conditioners have a blue-grey Hammermatic finish that blends well with any surroundings.

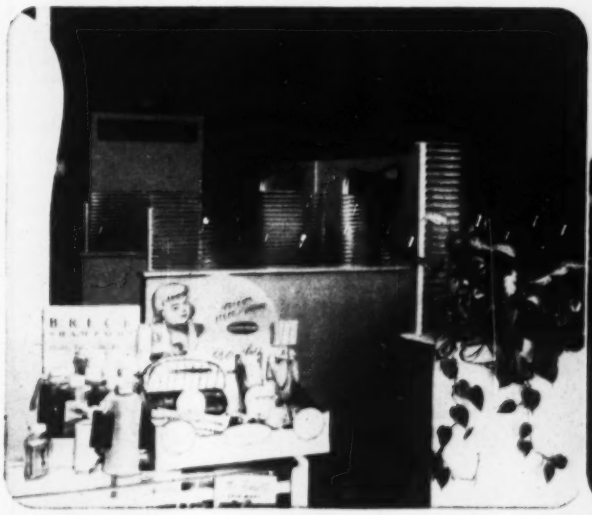
TRADE FRICK MARK® **Air Conditioning THROUGHOUT**

The eleven stores in the big new Freedom Shopping Center in Baltimore, built and owned by Henry J. Knott Enterprises, are all kept cool and comfortable with Frick Unit Air Conditioners. Several of these are tied-in with heaters of year-'round use. Installation by the Paul J. Vincent Co., Baltimore Distributors who have put Frick Air Conditioning in over 100 theatres.

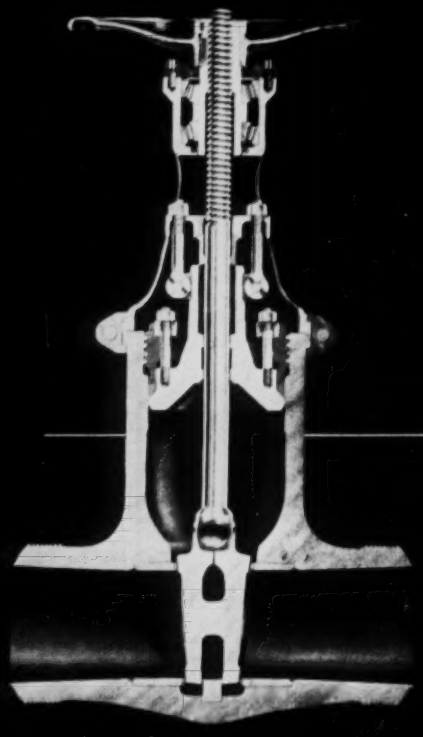
Frick Refrigerating and Air Conditioning Equipment can solve YOUR cooling problems equally well. Write

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



The Beauty Salon and Drug Store at Freedom Shopping Center.



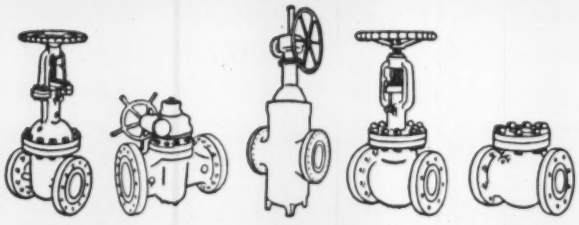
STEEL

COMPLETE LINES OF CAST STEEL VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of pressure classes, types, sizes, and patterns for general industrial use. Walworth also manufactures cast steel valves for specific service applications.

Walworth produces steel bar stock valves, and cast steel valves made of carbon steel, carbon molybdenum steel, corrosion-resistant, and heat-resistant alloy steels. Included are gate, globe, angle, check, and lubricated plug types. Sizes range from ⅛ to 30 inches; pressures range up to 5,000 psi. Full information is contained in Walworth General Catalog 52, a copy of which will be forwarded if requested on business letterhead.

Walworth also manufactures complete lines of valves and fittings made of bronze, iron, and special alloys as well as steel. Walworth-made valves, fittings, and pipe wrenches total approximately 50,000 items.

Walworth engineers will be glad to help you with your problems. For full information, call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is an 8-inch Series 900, Walworth Pressure-Seal Cast Steel Gate Valve designed for high-pressure, high-temperature service. Pressure-Seal Valves are available in Series 600, 900, 1500 and 2500; sizes 1 to 16 inches. Small Cast Steel Valves, Series 1500, in angle and Y-globe types, are also available in sizes ranging from ¼ to 2 inches.

WALWORTH

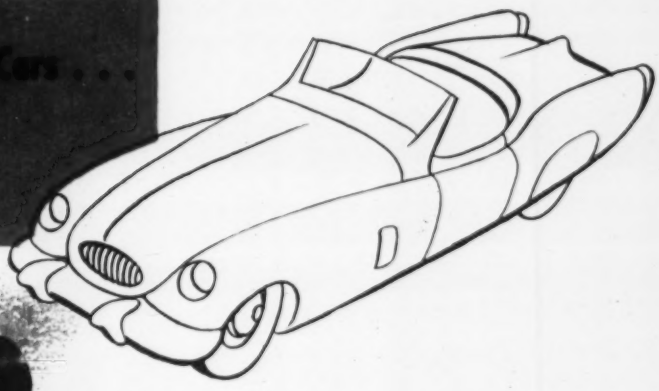
Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

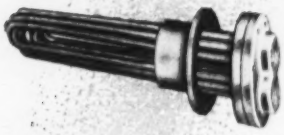
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

As Modern as today's Sports Cars . . .
. . . and just as efficient

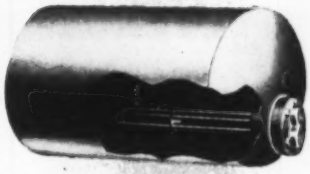


INSTANTANEOUS WATER HEATERS.
No tank required. 23 sizes; capacities to 300 gpm.; uses live or exhaust steam.

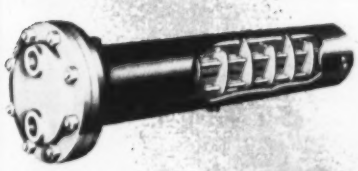
CONVERTERS.
26 sizes for economical heat transfer.



TANK HEATING UNITS.
20 sizes for all requirements.



STORAGE TANKS.
10 sizes; capacities to 315 gals.

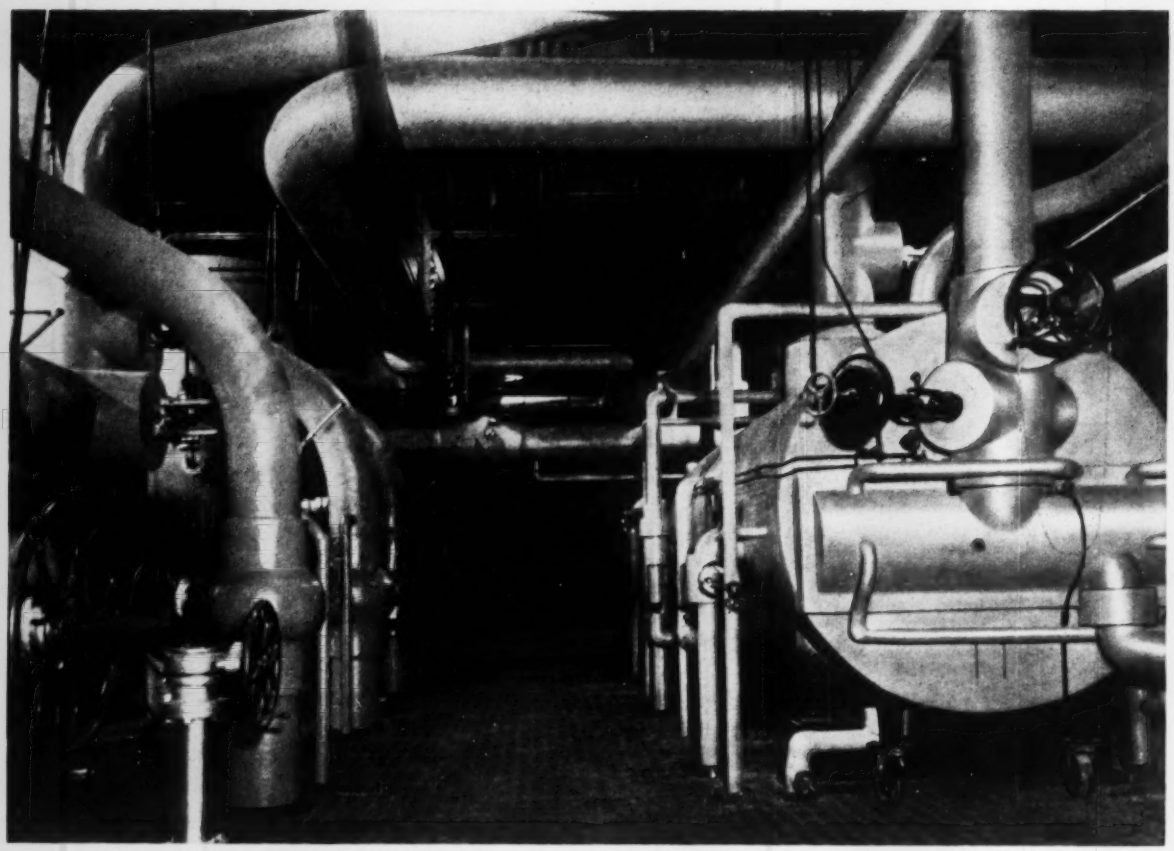


FUEL OIL HEATERS.
17 sizes; capacities to 375 gph. at 2 lbs. pressure.

INDIRECT HEATERS.
15 sizes for use with large-size storage tanks.

This specialized line of Industrial Fluid Heaters

Precisely engineered for maximum efficiency, this modern line of GENERAL Fluid Heating Specialties meets a wide variety of industrial applications. Whether you are planning a completely new installation, or the expansion or modernizing of an old one — you'll find a GENERAL unit that will give you efficient, extra long service at low cost. Detailed information is available in Catalog 60. Write for your copy. General Fittings Co., Dept. A, 123 Georgia Ave., Providence 5, R. I.



Scene in large southern power station. Main steam line and feeder equipment insulated with K&M Hy-Temp and "Featherweight" 85% Magnesia, in combination

Save heat-Save dollars

with K&M high-temperature insulations

For applications up to 1900°F., the combination to keep in mind is that of K&M Hy-Temp Insulation and "Featherweight" 85% Magnesia.

Two separate layers of insulation with vertical and horizontal staggered joints eliminate heat loss which occurs when expansion of hot piping and equipment causes joints to open in single layer installations. K&M Hy-Temp Insulation (diatomaceous silica), effective up to 1900°F. is applied directly to the hot surfaces and "Featherweight" 85% Magnesia Insulation (85% basic carbonate of Magnesia and asbestos fiber), effective up to 600°F. forms the second layer.

This effective K&M combination will last the life of the equipment it serves —will withstand moisture, vibration, alternate heating and cooling, wetting and drying. Both materials are supplied in all appropriate forms and thicknesses.

Your K&M distributor is an experienced applicator who will gladly give you more information about these heat-saving, money-saving K&M insulations. Or write directly to us.

Nature made Asbestos . . .
Keasbey & Mattison has made it
serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

Where the Flow Must Be Controlled...

● There is no better type of valve than the R-P&C Bar Stock. It's a fine throttling valve that positively controls flow. It's a sturdy, long-lasting valve made from solid bars of metal.

Male and female end type is made of carbon or chrome stainless in ¼" and ½" sizes, in globe and angle types. Others are made of bronze, stainless, or carbon and stainless in sizes ⅛" to 1". High temperature and pressure ranges.

R-P&C VALVES INCLUDE

Bronze
Iron
Cast Steel
Forged Steel
Bar Stock

See your R-P&C distributor today or write our Reading, Pennsylvania office for information

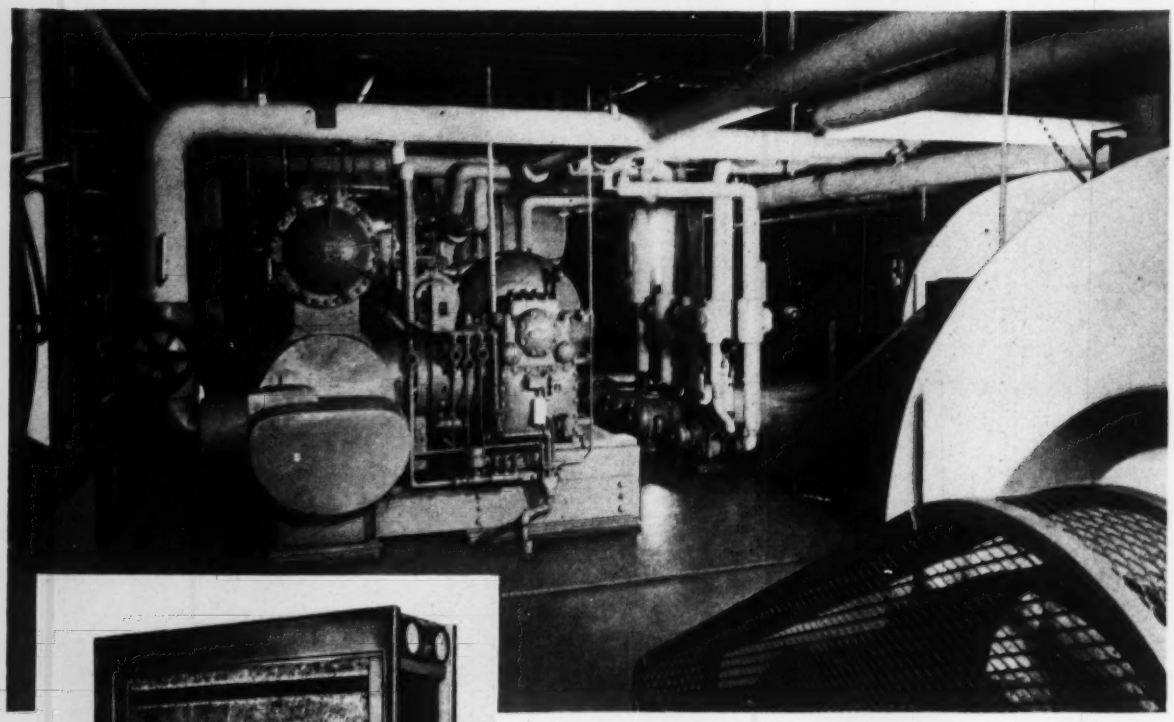
R-P&C valves

ACCO

TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.



Equipment room of Neisner's Rochester, N. Y. store where conditioned air is filtered in 3 units, each consisting of 2 sections, of Staynew Automatic Filters.

STAYNEW Automatic
Self Cleaning Type Filter

Where Automatic Filters are used

Neisner's Specify STAYNEW

For Air Conditioned Stores

More consistent filtration . . . more efficient operation . . . more effective control of dirt and dust in sales area than conventional filters. *ALL* good reasons why Neisner Brothers Inc., national retail chain, specified Staynew Automatic Air Filters in their large post war stores.

Staynew Automatic Air Filters adapt themselves to all types of air conditioning systems—cooling, either by direct expansion or chilled water; heating, or refrigeration. Self cleaning and easily supervised by laymen, Staynew Automatics stay on the job 24 hours a day at peak efficiency.

Let Staynew show you how to filter larger volumes of air at *lower* cost. Write for descriptive folder.

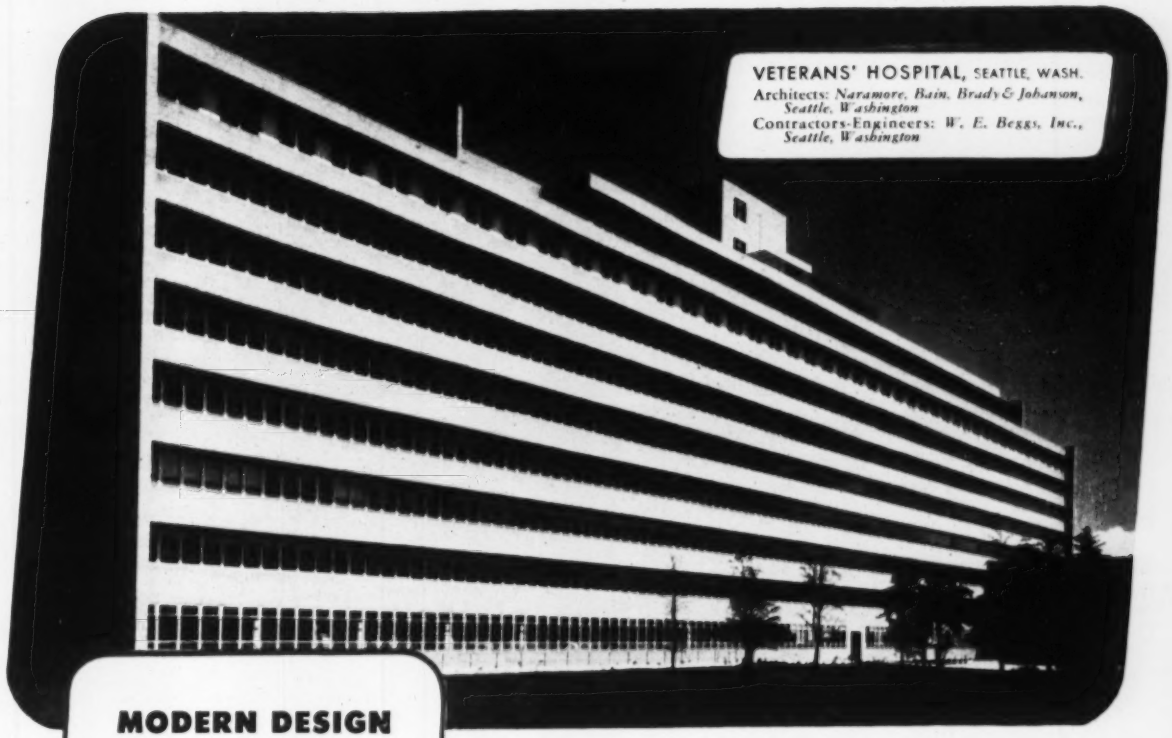
REPRESENTATIVES IN PRINCIPAL CITIES

DOLLINGER
REG PROTECTOMOTOR U.S. PAT. OFF.
STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED



VETERANS' HOSPITAL, SEATTLE, WASH.
Architects: *Naramore, Bain, Brady & Johanson, Seattle, Washington*
Contractors-Engineers: *W. E. Beggs, Inc., Seattle, Washington*

MODERN DESIGN DESERVES *modern heating*

The excellent temperature control and operating economy which characterize B & G *Hydro-Flo* Heating are dictating the use of this forced hot water system in institutional, commercial and industrial buildings.

B & G *Hydro-Flo* Heating permits close control of the heat supply... the temperature of the water circulating through the system is *automatically* raised or lowered to meet varying temperature conditions. The advantages of this *variable* water temperature are two-fold: The discomforts of over and under-heating are avoided and fuel consumption is held to a minimum.

Zoning a B & G *Hydro-Flo* System makes possible a further refinement of temperature control. Different sections of a building can be maintained at temperatures best suited to their functions... or compensation can be made for the effects of wind, exposure or solar heat.

B & G *Hydro-Flo* equipment is mechanically simple—does not require critical adjustment or complex control devices.

Typical circulating and water heating equipment as used in larger installations of B & G Hydro-Flo Heating.

B & G *Hydro-Flo** Heating

BELL & GOSSETT
COMPANY
Dept. CX-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.

They heated the "Outdoors"...in the 90's

A skyline of chimney pots was a striking sight in the 1890's . . . and a sign of heating inefficiency.

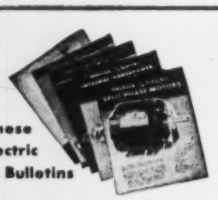
Compare the fireplaces and stoves of that day with modern central heating plants. Today's furnaces are marvels of efficiency in converting gas, oil and coal into clean, even heat that reaches every room.

Ever since 1908, when a furnace blower powered by an Emerson-Electric motor was introduced, we have been designing and producing motors for mechanical-firing and air-moving heating units. Many of the most famous names in the heating industry depend on Emerson-Electric motors for efficient, long-life operation for their products.

Ask us about Standard Motors in ratings from 1/20 to 5 H.P., and Hermetic Motor parts from 1/8 to 20 H.P.

***Write* THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.**

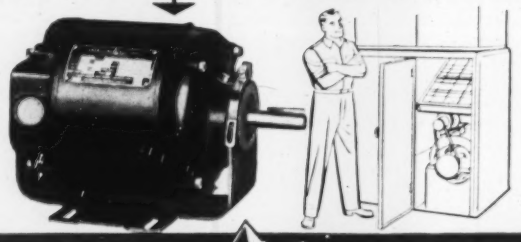
MODERN LIVING IS POWERED WITH ELECTRIC MOTORS



Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

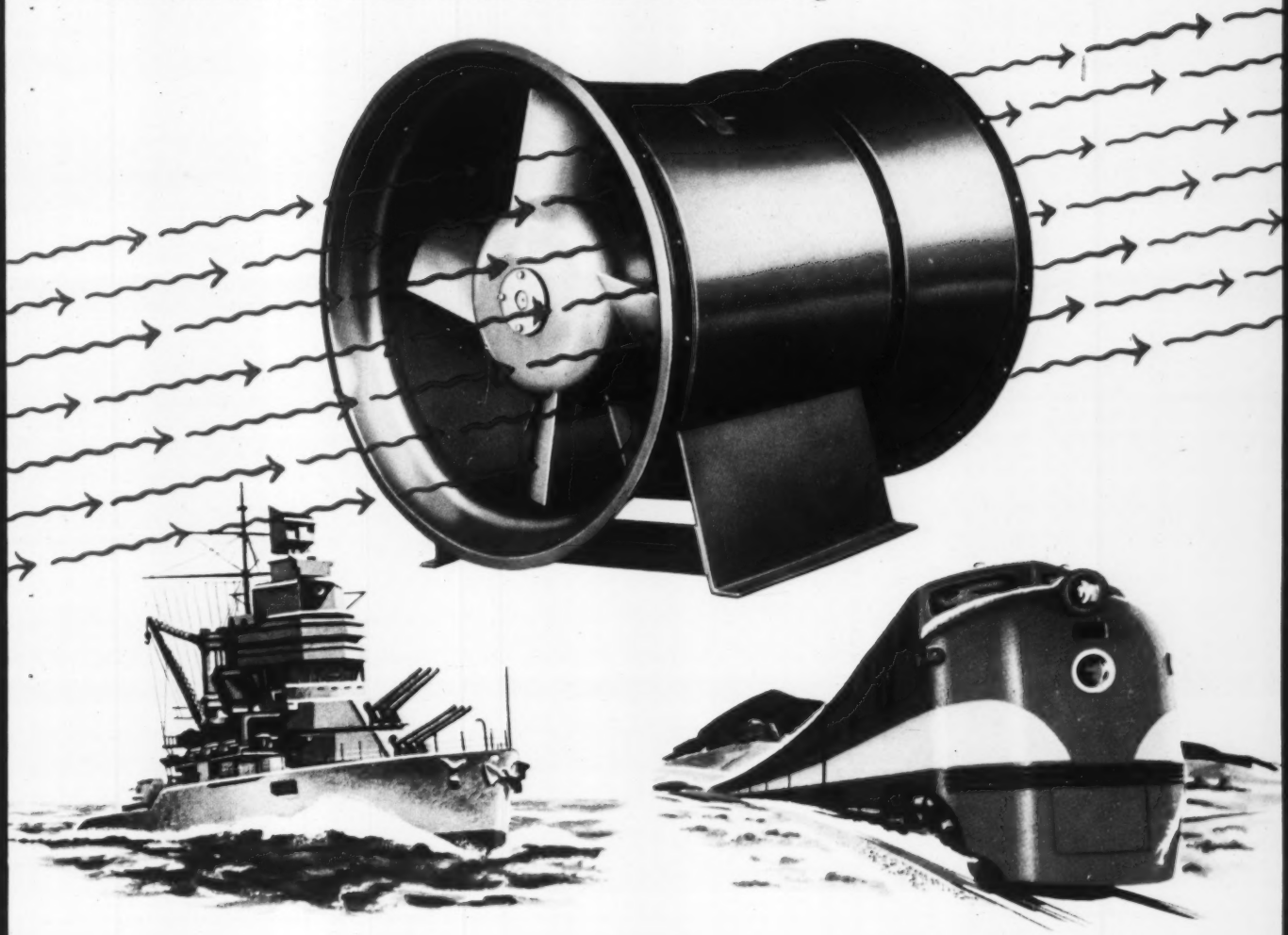
- ☐ M188-A Capacitor-Start
- ☐ M188-B Split-Phase
- ☐ M188-C Integral
- ☐ M188-D Fan-Duty
- ☐ M-188E Oil-Burner
- ☐ M-188F Jet Pump
- ☐ M-188G Blower



EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890

American Blower – a time-honored name in air handling



Dependable, low cost ventilation!

The Navy demands it on battlewagons . . .

Railroads specify it for modern streamlined trains . . .

Commerce and industry require it for the conduct of profitable business . . .

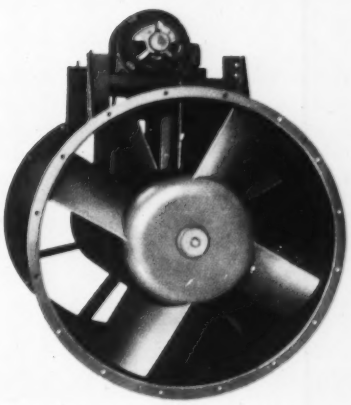
No one company has done more to provide dependable low cost ventilation than American Blower.

For example, American Blower Axial Fans are widely used in thousands upon thousands of varied applications, and are unsurpassed for ease of installation and efficient performance.

For complete information on axial fans and other American Blower Air Handling equipment, contact our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



American Blower Axial Fans are smooth in performance, built for endurance and convenient to install.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

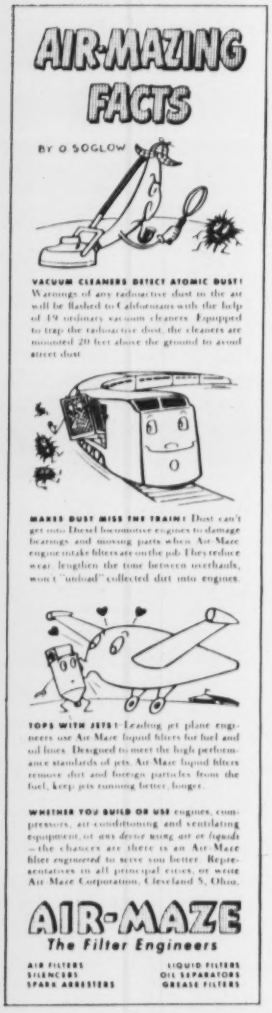
We'll pay $10.00 for AIR-MAZING facts like these:

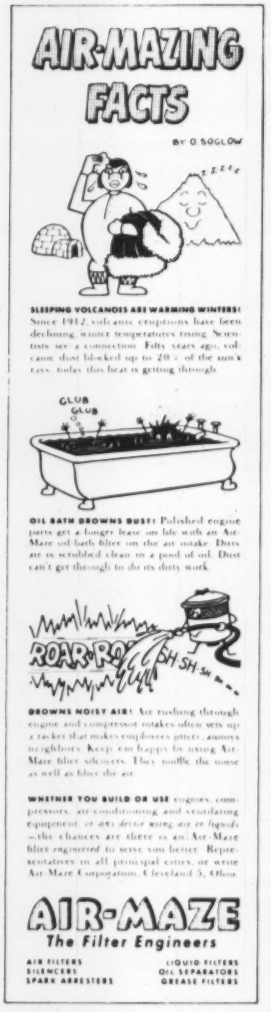
VACUUM CLEANERS DETECT ATOMIC DUST! Warnings of any radioactive dust in the air will be flashed to Californians with the help of 19 ordinary vacuum cleaners. Equipped to trap the radioactive dust, the cleaners are mounted 20 feet above the ground to avoid street dust.

GOLD MINE IN THE SKY! Smoke from the chimneys of ore smelting plants used to carry away valuable gold, silver and copper in the form of waste dust. By trapping the dust, they now save millions of dollars worth a year.

SLEEPING VOLCANOES ARE WARMING WINTERS! Since 1912, volcanic eruptions have been declining, winter temperatures rising. Scientists see a connection. Fifty years ago, volcanic dust blocked up to 20% of the sun's rays; today this heat is getting through.

to use in national advertisements like these:





Do you know any unusual facts about dust and air like the Air-Mazing facts at the top of this page? We'll pay $10.00 for each fact we accept and publish. Send fact and source of its origin to Air-Maze Corporation, 25000 Miles Road, Cleveland 28, Ohio.

MIDWEST

The Only Change is in the Name

MIDWEST PIPING & SUPPLY CO., INC.
has Changed its Name to

Midwest Piping Company, Inc.

6283

Because the word "Supply" is no longer accurately descriptive of the major business operations of this company, the stockholders have voted to drop it from the corporate name.

There has been no change in management, ownership or business at Midwest . . . and none is contemplated. Only the name has been changed. Midwest continues all its activities in the fabrication and installation of piping, and in the manufacture of welding fittings.

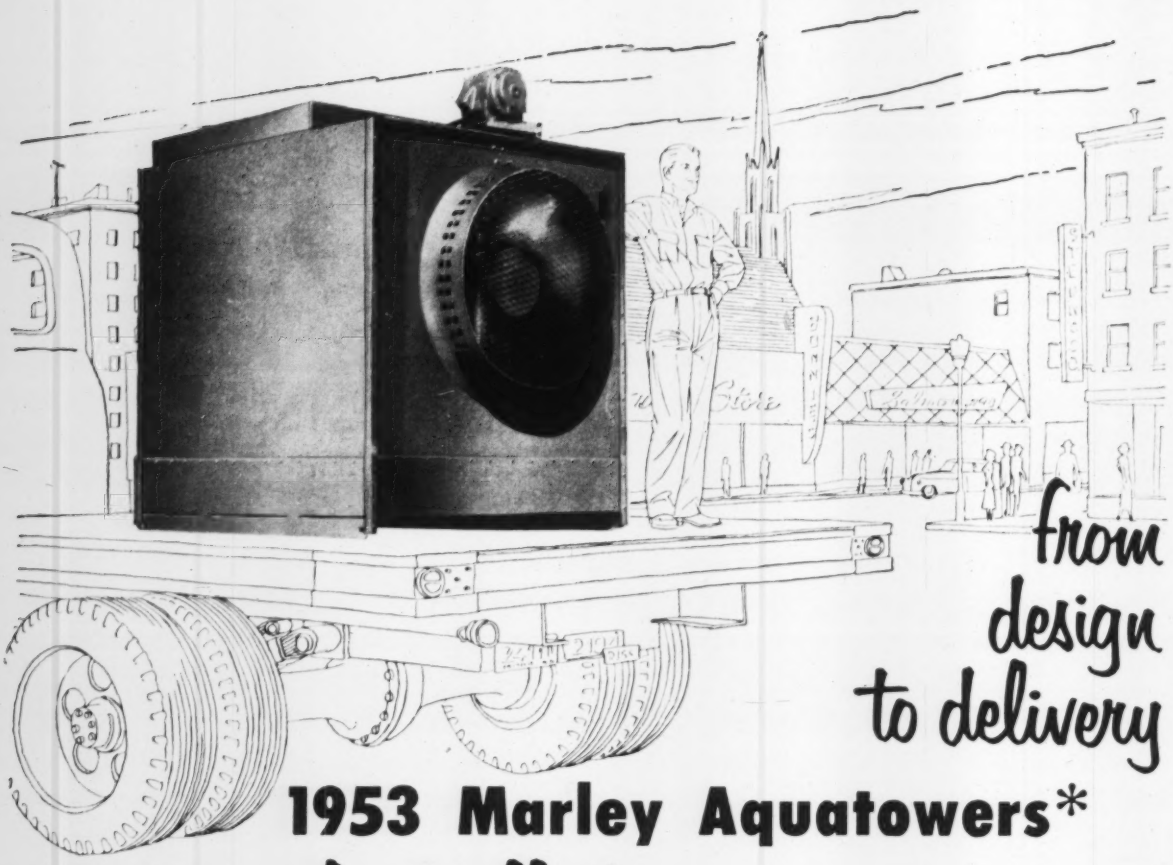
MIDWEST PIPING COMPANY, INC.

Executive Offices: 1450 South Second St., St. Louis 4, Mo.

Plants: ST. LOUIS, PASSAIC, LOS ANGELES and BOSTON

Sales Offices: NEW YORK 7—50 CHURCH ST. • TULSA 3—224 WRIGHT BLDG.
CHICAGO 3—79 WEST MONROE ST. • LOS ANGELES 33—520 ANDERSON ST.
HOUSTON 2—1213 CAPITOL AVE. • BOSTON 27—426 FIRST ST.

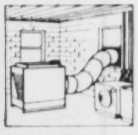
PIPING FABRICATORS AND CONTRACTORS FOR MORE THAN 50 YEARS
MANUFACTURERS OF WELDING FITTINGS FOR MORE THAN 20 YEARS



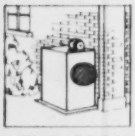
from design to delivery

1953 Marley Aquatowers* lead all the way

ON THE ROOF



INDOORS



ON THE GROUND

Write for Bulletin AQ-53A and name of your nearest Marley Sales Engineer.

Right down the line—in design, construction, performance, availability—Marley Aquatowers continue to be the best buy for water cooling in the 2- to 60- ton range, as they have been for more than a decade.

To the carefully engineered design that has made Aquatowers the most popular of all cooling units, new important refinements have been added. Your Marley representative will gladly explain these improvements that assure even greater acceptance for Aquatowers.

Structural ruggedness is characteristic of the line. All are of heavy gauge steel, welded into perfectly integrated units. Interiors are completely protected by a heavy coat of Marmastic compound.

These well-designed, well-built towers are conservatively rated. They will deliver specified performance . . . are guaranteed to do it. This means that you can select the correct unit for each job. You don't over-buy or overload when you install Aquatowers.

And when you need them, Aquatowers will be available. Production schedules and plant facilities have been expanded to meet the most optimistic forecasts for the air conditioning industry's greatest year. Aquatowers are now stocked in 30 cities for your convenience.

*Reg. trade-mark

MARLEY

The Marley Company

KANSAS CITY, MISSOURI

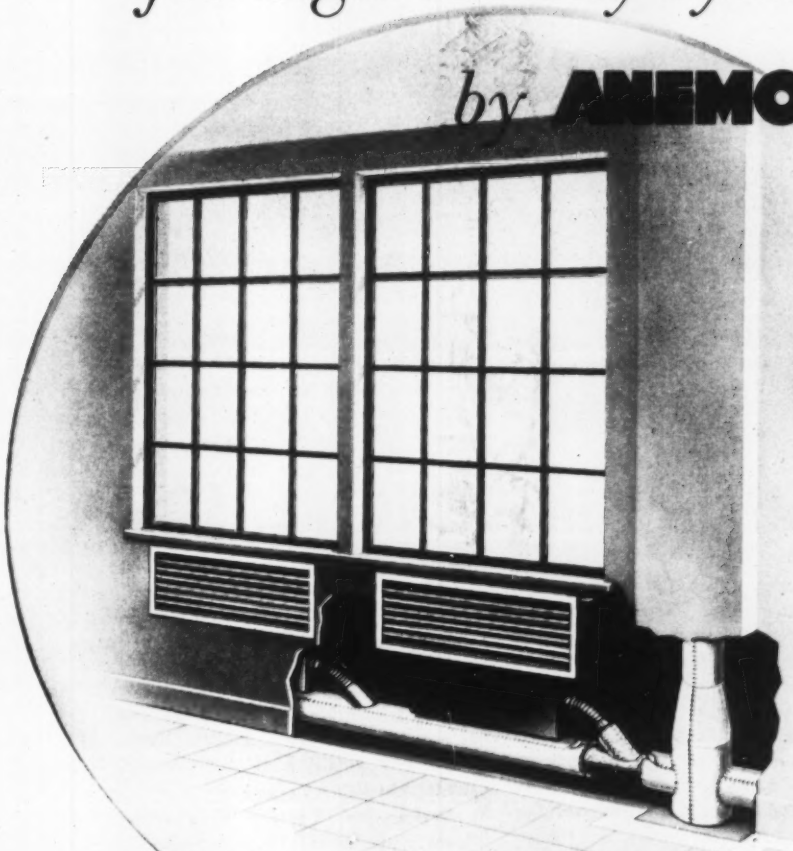
The New

UTW

UNDER THE WINDOW UNIT

for high velocity systems

by **ANEMOSTAT**



The Anemostat "ALL AIR" Under-the-Window Unit offers many new applications for high velocity air distribution. This unit requires no coils, drains, drip pans, or special thermostats and can be simply installed at low cost.

COOLING—Primary cooled air, having been mixed with induced room air, is propelled upward from the unit and further mixed with the warm air from the windows and exterior wall and is then draftlessly diffused throughout the occupied space. Controlled internal induction permits the use of temperature differentials up to 35°.

HEATING—By reducing the controlled induction, high temperature air is propelled upward from the unit and is mixed with the cold air from the windows. The temperature is thus equalized and the air is then draftlessly diffused throughout the occupied space.

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

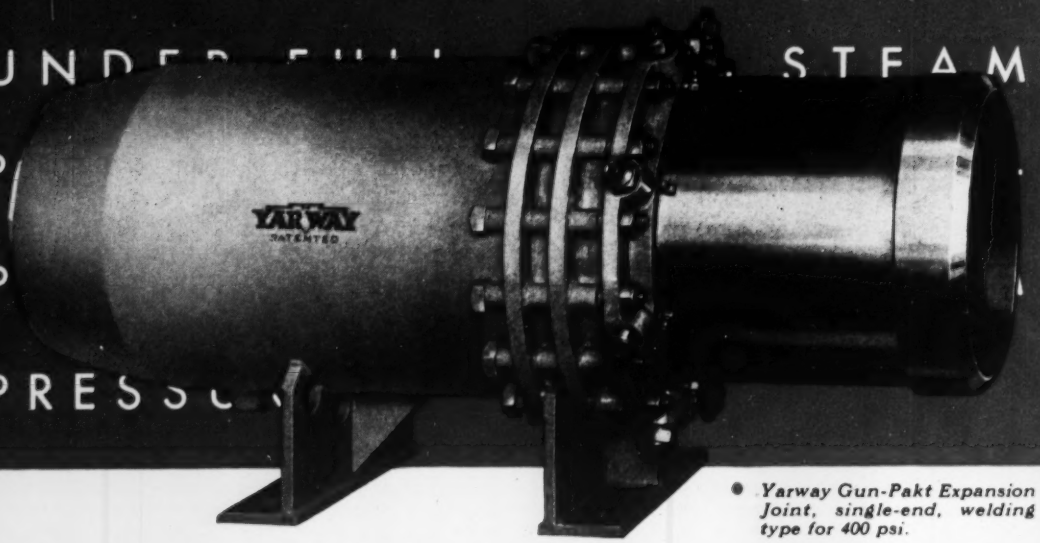
10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

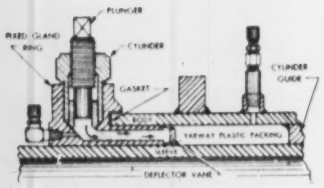
AC

GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED UNDER FULL STEAM PRESSURE • GUN-PACKED



• *Yarway Gun-Pakt Expansion Joint, single-end, welding type for 400 psi.*

BEHIND IT...AN ENGINEERING REASON



Cross-section of Gun-Pakt feature.

More large central station heating plants are using Yarway Gun-Pakt Expansion Joints in their steam distribution lines than any other type. This popularity of Yarway Gun-Pakt Expansion Joints in public utilities, institutions and industrial plants is due to the engineering reason behind them . . . *they are packed by a gun under full steam pressure.*

No shutdowns of steam lines, no production delays . . . you just insert a plug of Yarway plastic packing, twist a wrench, and the joint is tight, the job is done.

Such labor saving features, combined with impressive records of low maintenance requirements, make Yarway Gun-Pakt Joints a natural selection for your steam lines. Certainly you'll find them worth investigating.

Write for Yarway Expansion Joint Bulletin EJ-1912.

YARNALL-WARING COMPANY
107 Mermaid Avenue • Philadelphia 18, Pa.

YARWAY | gun-pakt expansion joints

HIGHLY RECOMMENDED

for low cost service

CRANE

IRON BODY—WEDGE DISC

Clamp Gate Valves

Low in first cost, as well as in upkeep . . . and look at their wide utility—

Use Crane Clamp Gate Valves for steam; hot and cold water; crude, fuel, and lubricating oil; air, gas, and gasoline service.

Also in food and chemical process industries for caustic solutions, alkalies, corrosive chemicals, and gases.

You'll find Crane Clamp Gate Valves extra rugged, with a strong reinforced body and husky stem. Their compact design means a better fit for more places . . . a saving on piping in many cases. And because of the simplified clamp construction, these valves enjoy wide favor where frequent cleanout is essential. The bonnet assembly and wedge disc lift out easily—the body stays in the line. Reassembling is no problem—the bonnet joint makes up tight and stays tight.

Wide choice of regular patterns, all-iron or brass trimmed. On inside screw all-iron valves, an improved self-draining bonnet prevents entrapment of line fluids in the bonnet—protects the threads, keeps the stem working smoothly. Send for Folder AD 1667 or ask your Crane Representative for full details.

Crane Wedge Disc Clamp Gate Valves come in OS&Y, inside screw, and quick-opening patterns, all-iron or brass trimmed, screwed or flanged end. Sizes up to 4 in. Working pressures up to 150 p.s.i. saturated steam, 225 p.s.i. cold service.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

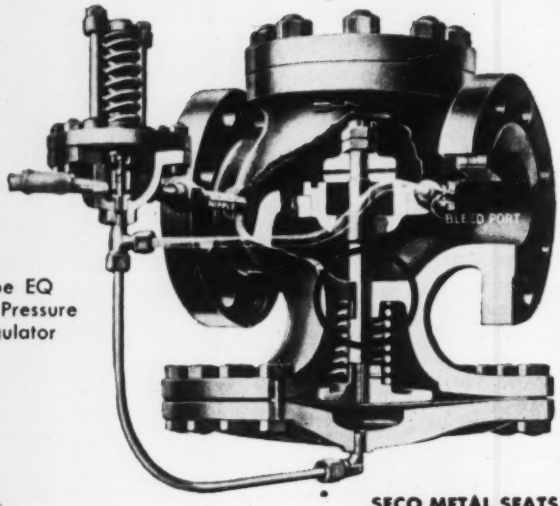
HOW SPENCE DESIGN...

eliminates stuffing boxes

All Spence main valves and most pilots are built without stuffing boxes. This packless construction is made possible by the use of a large balanced metal diaphragm which eliminates the need for closely fitted parts. Result? More accurate regulation.

Valve stem wear is also reduced in the Spence packless design. Result? Low maintenance, years of trouble-free service.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governors and many other types. Write for bulletin 100 giving full details.



Type EQ
Back Pressure
Regulator

A few other design features:

SECO METAL SEATS AND DISCS— Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

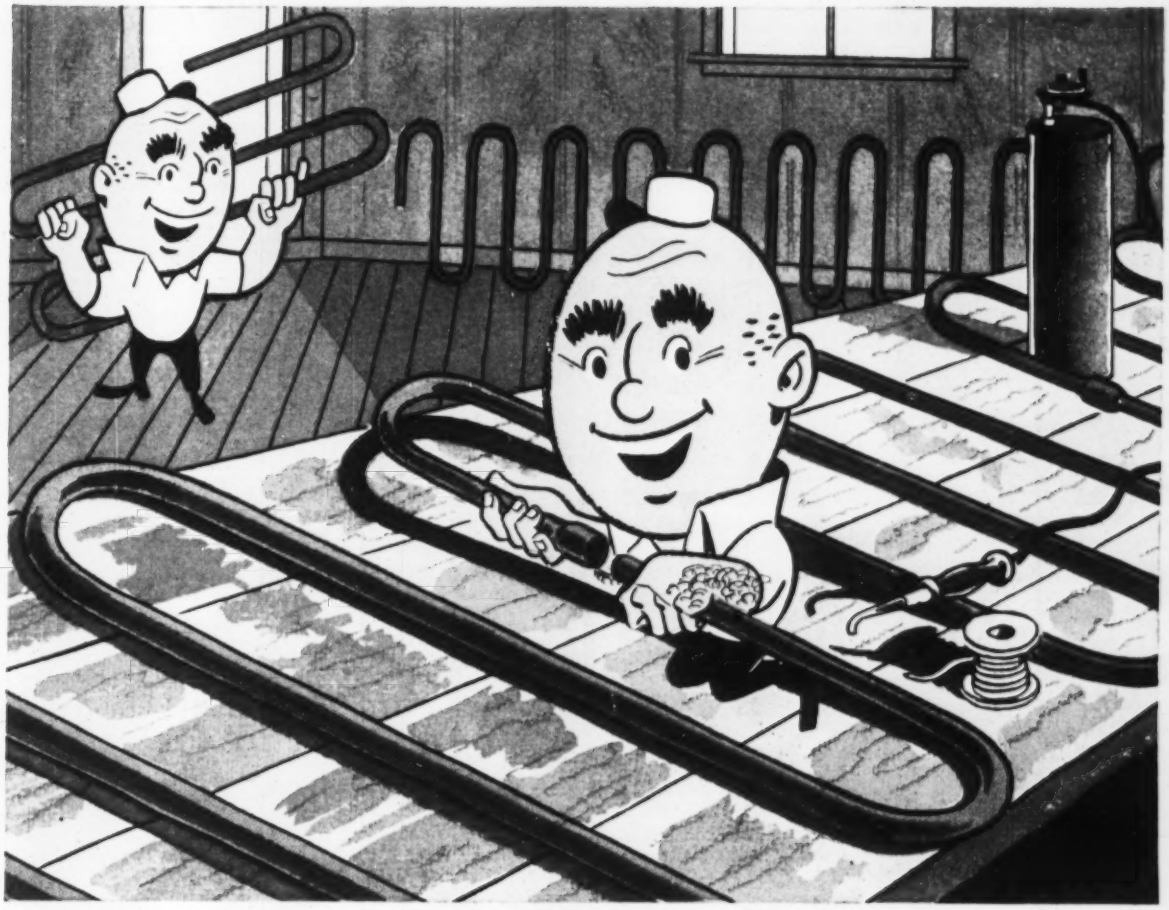
PROTECTED SPRINGS— The internal springs in the Spence Main Valve and Pilot are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life.

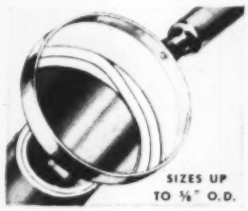
METAL DIAPHRAGMS — Located in a cooled zone with a condensate seal above and below, never have to be replaced under normal conditions.

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

BE 121





Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner-walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20′ lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Beat the bandwagon . . . Take on Bundyweld Ceiling Radiant Heating NOW

Here today is the best chance ever to get the jump on your competitors . . . to beat the bandwagon they'll *all* be trying to ride tomorrow!

Start featuring Bundyweld Ceiling Radiant Heating now. Here's sales appeal! . . . heat that's as clean as a breeze, as refreshing and even as sunshine. Here's a tested, trouble-free system that gives the whole house—*every inch of it*—the same pleasant warmth. Yet it actually costs *less* to run.

It's no wonder buyers are getting excited about it . . . and they *are* getting excited! Millions of people all over the country are reading Bundy ads in *Better Homes and Gardens, American Home, Small Homes Guide*, and *House Beautiful*. Their requests for literature have rolled in like an avalanche. And everywhere buyers are writing for the names of plumbing and heating contractors who handle Bundyweld Ceiling Radiant Heating *in their areas*.

Somebody in your community is going to cash in on this tremendous wave of public enthusiasm. Why not you? Send for your Bundy literature today.

Radiant Heating Division
BUNDY TUBING COMPANY
Detroit 14, Michigan

SEND FOR FREE LITERATURE!

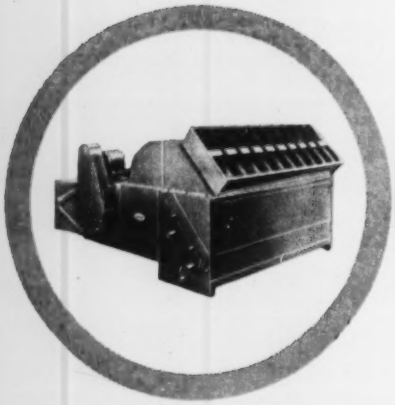
Bundyweld
Ceiling Radiant Heating

Radiant Heating Division, Dept. HP-453
Bundy Tubing Company, Detroit 14, Mich.

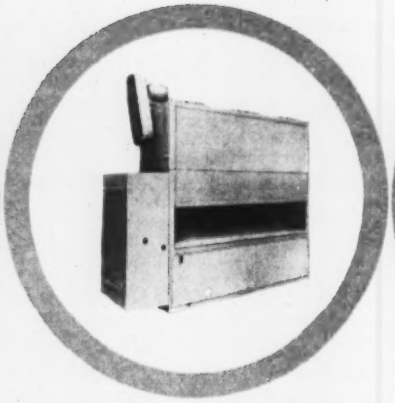
☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.
☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____
Company _____
Address _____
City _____ Zone ____ State _____

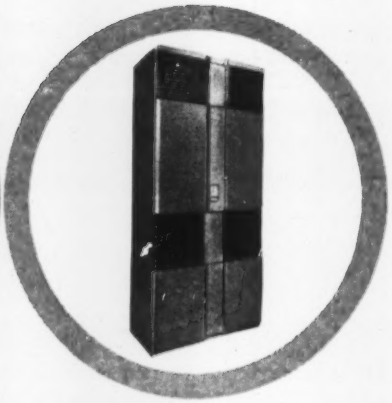
Get your money's worth with CARRIER!



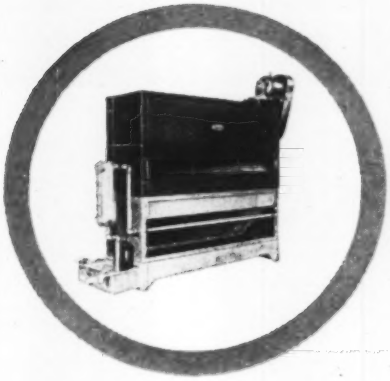
Zoning Weathermakers — Fan-coil unit for zoned air conditioning systems that use remote sources of refrigeration and heat. Provides year-round air conditioning with individual room control. Available in five sizes, up to 90 tons.



Commercial Weathermakers — Compact self-contained unit for comfort and industrial applications with duct distribution. Basic assembly includes fan, cooling coil, refrigerating sections. Optional accessories can be added. 20 hp capacity.



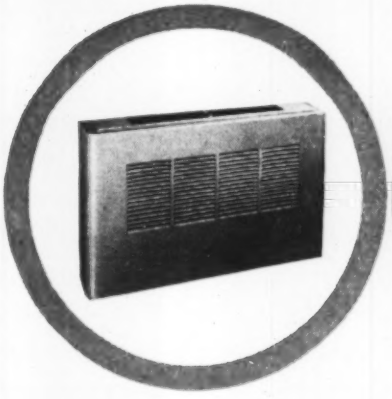
Self-contained Weathermakers — Complete packaged unit for air conditioning stores, shops, offices, laboratories. Used in the space or remote location, with or without duct distribution. Available in six sizes from 2 to 15 hp.



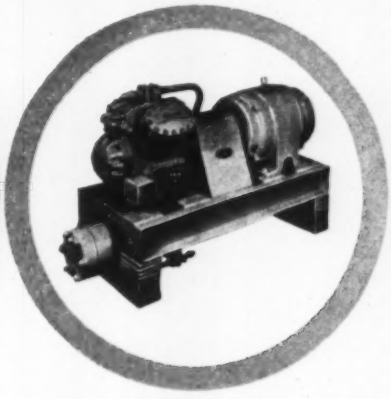
Industrial Weathermakers—Single unit spray-coil air conditioner for central cooling and heating systems using remote sources of refrigeration and heat. Cools, dehumidifies, heats, humidifies, filters and circulates air. Five sizes, up to 90 tons.

Evaporative Condensers—For heat disposal where water supply and drainage are problems, this fan-coil type refrigerant condenser takes the place of water-cooled condensers and cooling towers. Capacities to 90 tons.

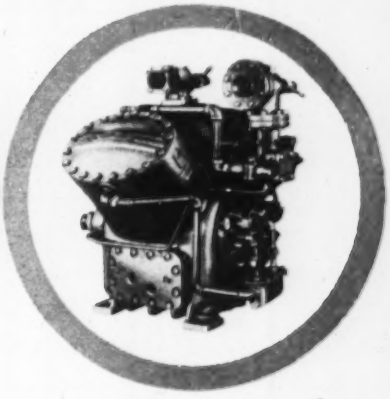
System Weathermakers—Fan-coil type air conditioner for central cooling and heating systems using remote refrigeration and heat. Seven basic fan and coil section sizes used with any one of four cooling coil capacities make 28 different sizes.



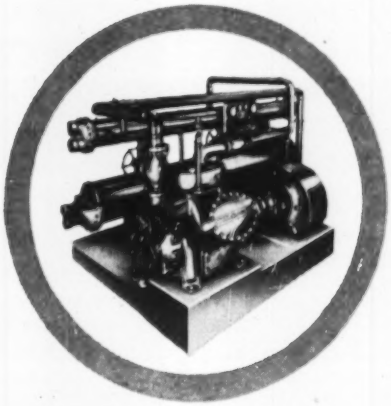
Duct-type Weathermasters—Low-pressure air distribution room units—ideal for hospitals, hotels, office buildings, apartment buildings, laboratories, banks and schools that have a remote source of refrigeration and heat.



2 to 125 hp Freon Refrigerating Compressors and Condensers—Heavy-duty reciprocating type for air conditioning and refrigeration applications. Uses Freon-12, Freon-22 or Carrene 7. Direct or belt drive. Used with water-cooled or evaporative condensers.



75 to 200 hp Reciprocating Compressors—For large commercial and industrial applications like freezing and processing. For industrial and comfort air conditioning. Heavy-duty V and W types, single-acting, enclosed. Direct, gear or belt driven.



100 and 150 hp Refrigerating Machines—Complete reciprocating systems for cooling water or brines for air conditioning and industrial process applications. Driven by electric motor, gas or Diesel engine, or steam turbine.

This complete line of equipment is available to contractors through Carrier Branch Offices, Dealers and Distributors. Your Classified Telephone Directory will put you in touch with the one nearest you. Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING • REFRIGERATION

INDUSTRIAL HEATING

A portion of the revolving book cases at the Midwest Inter-Library, at Chicago where more than 36,000 lineal feet of books and documents are housed to serve the research needs of fifteen institutions.

Architects for the building: SHAW, METZ AND DOLIO.

CLEAN AIR preserves the perishable pages and covers of hundreds of thousands of books and technical and historical documents in the new

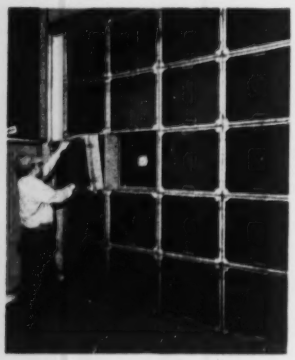
MIDWEST INTER-LIBRARY CENTER

The designers of the new Inter-Library Center of Chicago specified the AAF ELECTRO-PL ELECTRONIC AIR FILTER to protect the more than 36,000 lineal feet of books, documents and periodicals deposited in the new Inter-Library building against dust discoloration and smoke damage caused by impurities in ordinary air.

This huge research library serves fifteen institutions and is a clearing house for material needed in almost every phase of scholastic research. The new center provides a speedy central source of information and technical data and eliminates duplication of source material among the participating institutions. To assure absolute protection for the valuable documents housed in the new library—*Clean Air* was a necessity.

AAF—manufacturers of the only *complete* line of air cleaning equipment in the world . . . was able to supply the ideal equipment for this building.

If you have an air cleaning problem, the experience of American Air Filter engineers can be of help to you. We welcome your inquiries and will supply you with complete information and Experience Reports without obligation. Please address your requests to American Air Filter Company, Inc., Louisville 8, Kentucky.



This illustration shows a part of the ELECTRO-PL Dry-Type electronic air filter installation which delivers 25,000 c.f.m. at the new Midwest Inter-Library Building in Chicago.

ELECTRO-PL is the only electronic air cleaner with the famous AAF "double protection" feature. If a power failure should occur in a building—the ELECTRO-PL will continue to function as one of the most efficient dry-type filters ever developed.

Expect the Best from . . . . .

American Air Filter

COMPANY, INC.

373 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

FOR *ALL* YOUR
AIR CONDITIONING PUMPS

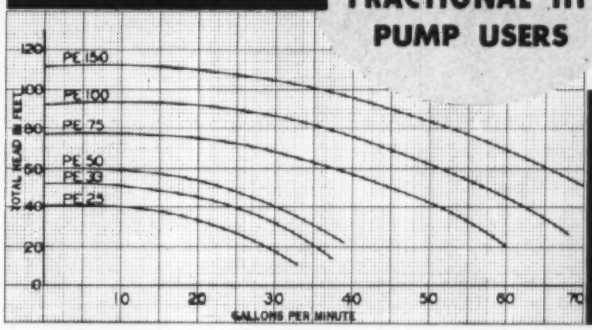
Fluidyne LINE...

PEERLESS PUMPS

GET *HIGHEST* EFFICIENCY

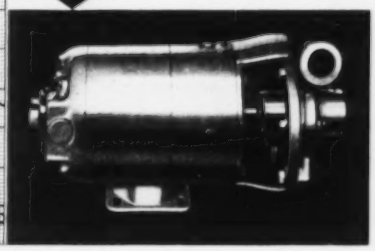
plus COMPACTNESS · ECONOMY · DURABILITY *and* EASY MAINTENANCE

HERE ARE THE RATINGS FOR FRACTIONAL HP PUMP USERS



HERE'S THE PUMP

PEERLESS FLUIDYNE
TYPE PE PUMP—¼ TO 1½ HP

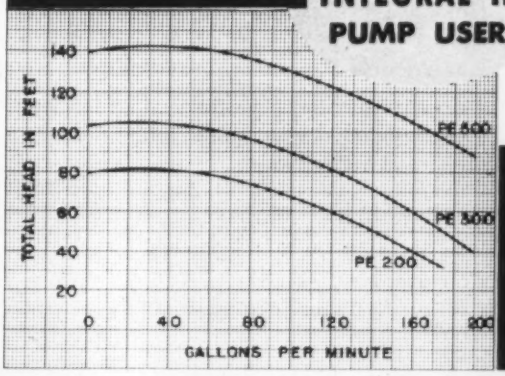


KEY TO CHART

Performance chart showing head capacity characteristics of Peerless Type PE fractional hp Fluidyne pumps at 3450 rpm

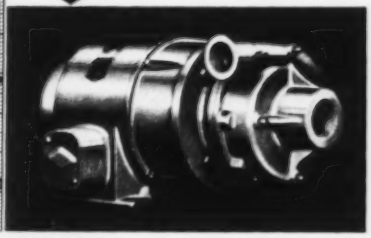
PUMP HP
PE 25—¼ hp
PE 33—⅓ hp
PE 50—½ hp
PE 75—¾ hp
PE 100—1 hp
PE 150—1½ hp

HERE ARE THE RATINGS FOR INTEGRAL HP PUMP USERS



HERE'S THE PUMP

PEERLESS FLUIDYNE
TYPE PE PUMP
2 TO 5 HP



KEY TO CHART

Performance chart showing head capacity characteristics of Peerless Type PE integral hp Fluidyne pumps at 3450 rpm

PUMP HP
PE 200—2 hp
PE 300—3 hp
PE 500—5 hp

Both Types - EQUIPPED WITH MECHANICAL SHAFT SEALS

-NO MORE PACKING TROUBLES. ANNOYING, UNSIGHTLY LEAKS ARE ELIMINATED, ONCE AND FOR ALL!

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address inquiries to Factories at
Los Angeles 31, California and Indianapolis 8, Indiana
Offices: New York, Chicago, St. Louis, Atlanta, Tulsa, Dallas, Plainview and Lubbock, Texas; Fresno, Los Angeles; Phoenix, Albuquerque, N. M.

PEERLESS PUMPS fmc

Mail Coupon Today for Bulletin!

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, Calif.

Please send without obligation new Bulletin B-2300 describing Fluidyne line of fractional and integral hp pumps.

NAME .....
COMPANY .....
STREET .....
CITY ..... STATE .....

HPAC

FIRST *complete* packaged boiler

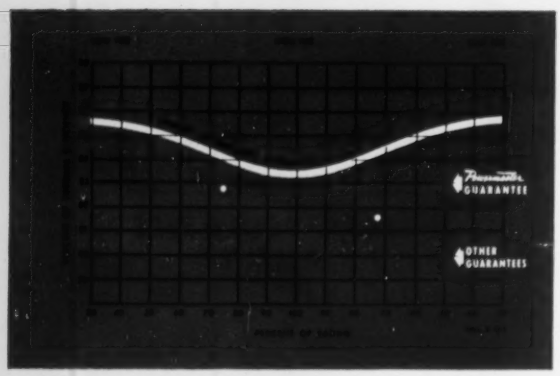
FIRST full modulating cam control

FIRST *Voriflow* air-atomizing burner

FIRST immediate change-over—oil or gas

NOW—*Powermaster*® is FIRST to guarantee 83% minimum efficiency

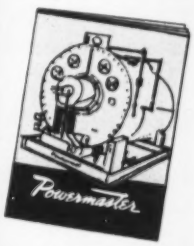
The "pay-off" on a boiler is its operating efficiency . . . and *only Powermaster guarantees a minimum of 83%* with No. 6 oil!



Take a look at the typical efficiency curve of *Powermaster* shown here . . . then compare A.S.M.E. tests with those of any other boiler. At less than full load (which is normal in field operation) notice that *Powermaster* efficiency actually *increases.*

There's a reason for such efficiency. The *Powermaster* is the development of 68 years' experience in boiler manufacture. Continuing research and progressive engineering have resulted in *Powermaster* users being the first to benefit from major improvements in packaged boiler design.

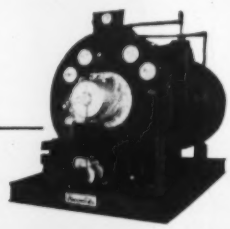
Point-by-point, *Powermaster* welcomes comparison. Before deciding on a new boiler for your plant, be sure to get the facts on the newest *Powermaster* with *Voriflow* combustion. Just drop us a line and we'll be glad to send you our new catalog.



Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • *Established 1885* • 990 MORGANTOWN ROAD, READING, PENNA.

THEY'RE LOOKING DOWN YOUR PIPELINE...

Those twin scourges of industry—Lost Production and High Maintenance—are constantly drawing a bead on economical operation . . . looking down this nation's arteries for the lines of least resistance to heat, pressure and corrosion.

There *is* one way to spoil their aim: make sure that *your* pipe and tubing sections are joined with fittings of a kind that match them in chemical and physical properties, in strength and weight.

W-S Double-Diamond FORGED STEEL Fittings in both screw-end and socket-weld types give you all these qualities . . . provide life-of-the-line joints for any kind of make-up.

Literature is available . . . write for it.

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY

MORE ENGINEERING
MORE MATERIAL
MORE EXPERIENCE

MAKE THE DIFFERENCE

KEWANEE
STEEL BOILERS

Kewanee Boilers have led their field for more than 85 years because Architects, Engineers, Contractors and Owners know they *get more from them . . .* and that is true because *Kewanee puts more into them.*

Check the measurements and specifications shown in every Kewanee catalog. You'll find more of all the features which make a boiler efficient and dependable . . . large, high fireboxes; generous heating surfaces; unimpeded water ways; unobstructed steam release areas; plenty of space for reserve steam. That's why one finds Kewanee Boilers "on the job" providing heat or power or process steam in America's finest buildings and industrial plants.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

PRUDENTIAL LIFE INSURANCE BUILDING
Houston, Texas
KENNETH FRANZHEIM
Architect
DALE S. COOPER & ASSOCIATES
Engineers
2 Gas-Fired Kewanees installed by
BARBER PLUMBING COMPANY

KEWANEE BOILERS

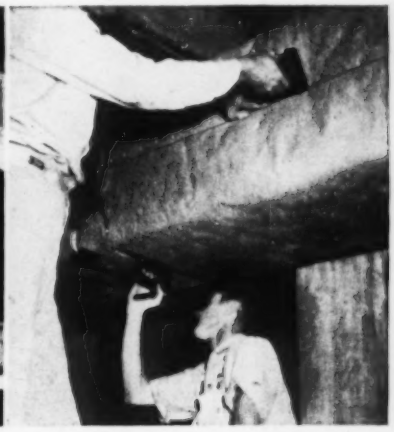
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

New "Wrap-'n-Staple" method of insulating ducts with ULTRALITE

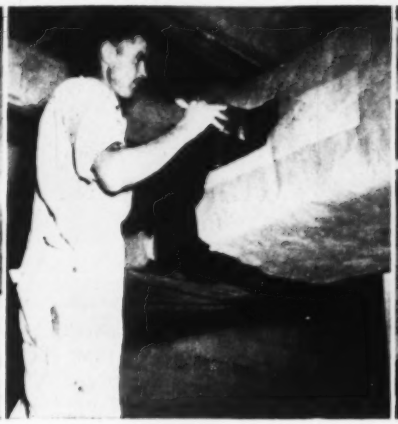
1 ULTRALITE glass fiber insulation, cut-to-size and already faced, hangs over duct. Spot daubing of adhesive helps hold ULTRALITE.

2 Wrapped around duct, ULTRALITE ends overlap. Insulation and vapor barrier facing are separated to form a 4" tab overlap to seal longitudinal joint.



3 Stapling gun converts loose tabs into secure longitudinal seam. Only ULTRALITE has the tensile strength that permits use of staples.*

4 4" strips of standard asbestos furnace paper, painted with wheat paste, are applied over joints. Tapes that match facing are also available.



5 Stripped joints are painted with a coat of waterproof mastic to make certain that vapor condensation will never be a problem.

6 If concealed, duct can be left as-is. If appearance is important, duct can be finished off with muslin or painted with a water-based paint.

Call your ULTRALITE distributor, listed in the Yellow Pages, for details and delivery of ULTRALITE Duct Insulation (thermal) and ULTRALITE Duct Liner (acoustical) . . . today!

*The revolutionary new Bostitch T5-8 "outward clinching" staple gun clinches staples in mid-air. No need to have a clinching anvil or use the duct surface to bend the legs of the staple!

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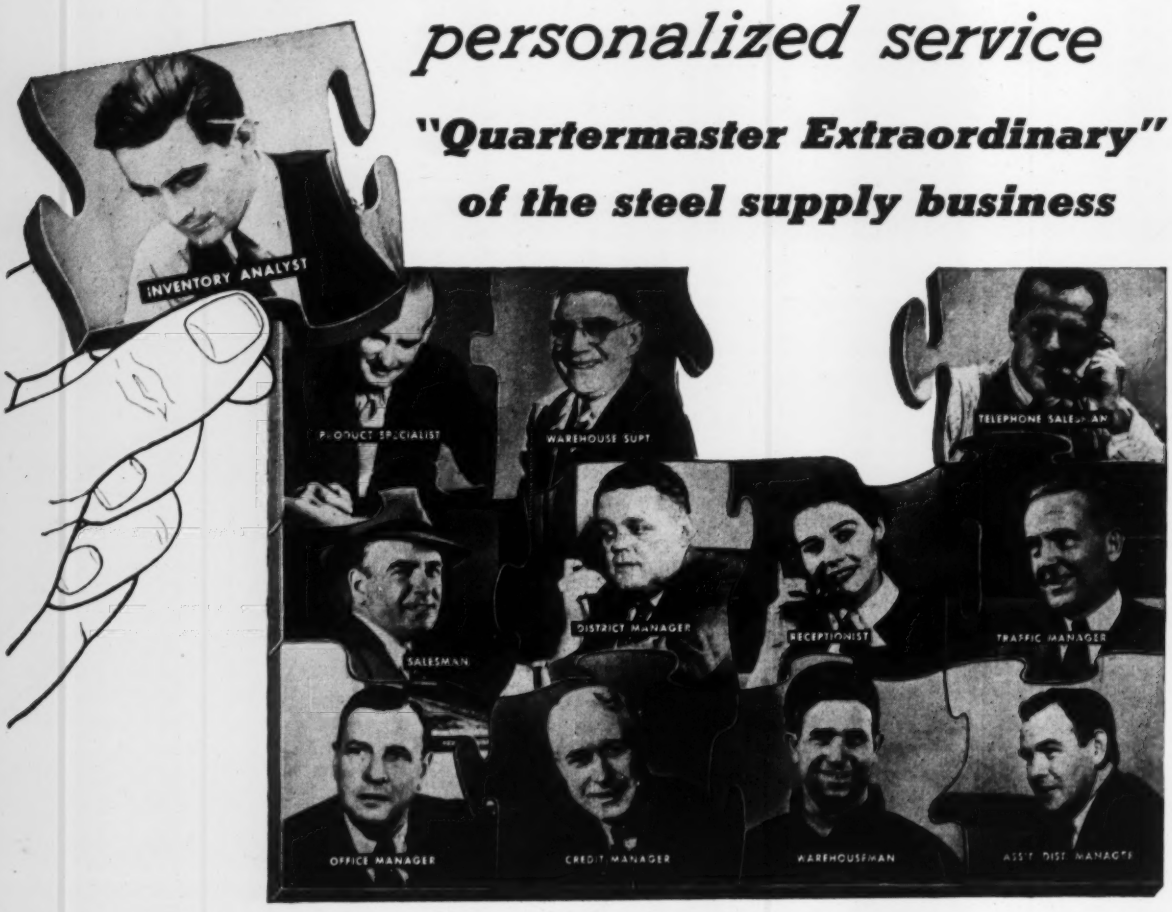
"Quartermaster Extraordinary" of the steel supply business



THE principal job of each Inventory Analyst is to keep his warehouse well stocked so that your orders can always be filled in the shortest possible time. His specialized knowledge of steel sources, mill schedules and the stocks of all our 14 warehouses is of particular value to you when you want to locate special types of steel, an item not ordinarily stocked, or steel that may be in short supply. He is, in effect, your purchasing agent for steel. Efficient buying, based on his knowledge of your requirements, helps us maintain a schedule of reasonable prices.

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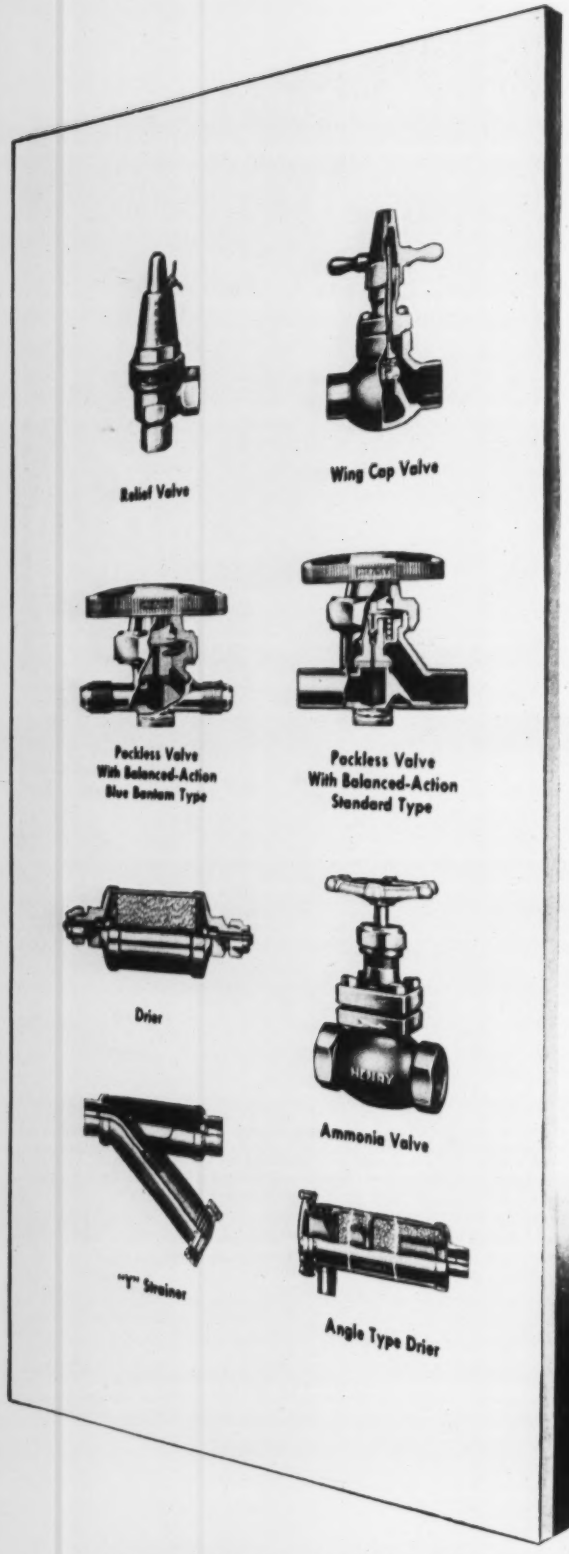

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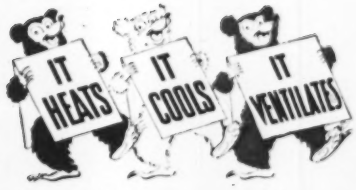
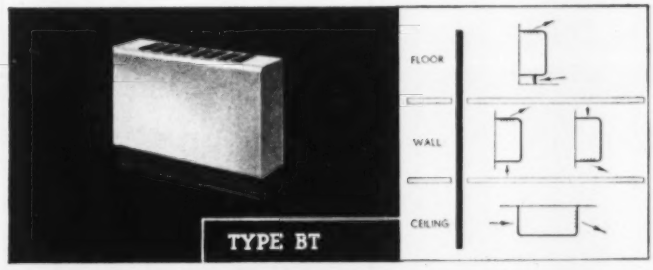
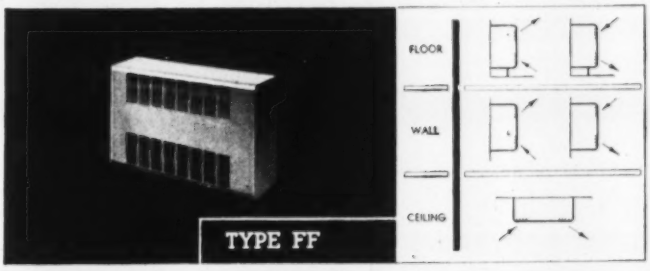
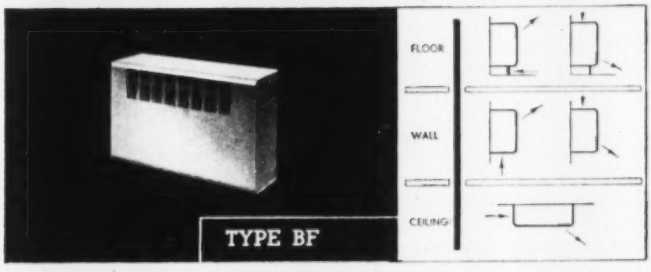


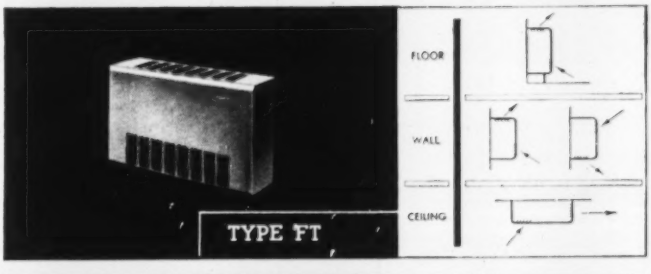
TOPS in VERSATILITY

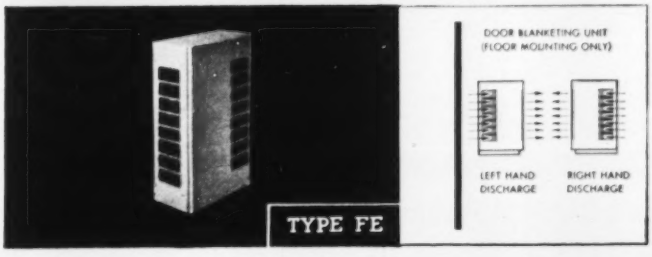
Modine Cabinet Unit provides year 'round comfort for any building











Choose from 5 attractively styled enclosure designs

FOR maximum heating flexibility, you can't beat Modine Cabinet Units. Five different models offer a wide variety of inlet-outlet combinations.

Some are for steam or hot water heating only. With others you can heat — or cool with chilled water. Inexpensive accessories permit ventilating with fresh outside air.

Mounted on floor, wall or ceiling, they provide quick, positive, quiet heat distribution. Ideal for concealed installation with ducts. And they're economical — cost considerably less to install than individual unit ventilators or air conditioners.

Whether you're planning new construction or modernization, be sure you see Modine's newly expanded line of Cabinet Units. For commercial, institutional or public buildings, they're the low-cost answer to year 'round comfort.

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CABINET UNITS

TEAR OUT COUPON AND MAIL TODAY for your free copy of illustrated bulletin. Or see your Modine representative listed in your phone book.

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Seating Capacity: 2000 Delegates, Visitors, Press, Radio, TV and Translators

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In addition to the main hall and council chambers Powers control is used for the many tiers of glass booths occupied by the press, radio, TV and translators; also lounges, restaurants, bars, library, radio studios and garage. There is also considerable control for wall and panel heating and snow melting.

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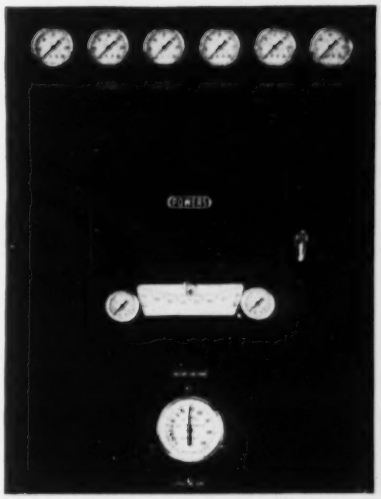
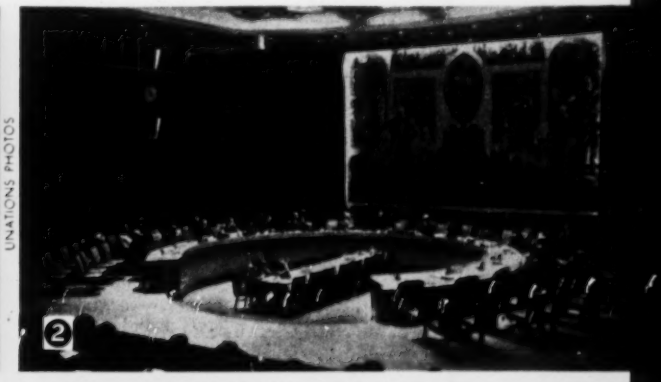
Experience gained by Powers here and in many other important large and small buildings may be helpful to you. Next time a temperature or humidity control problem arises, contact POWERS nearest office. There's no obligation.



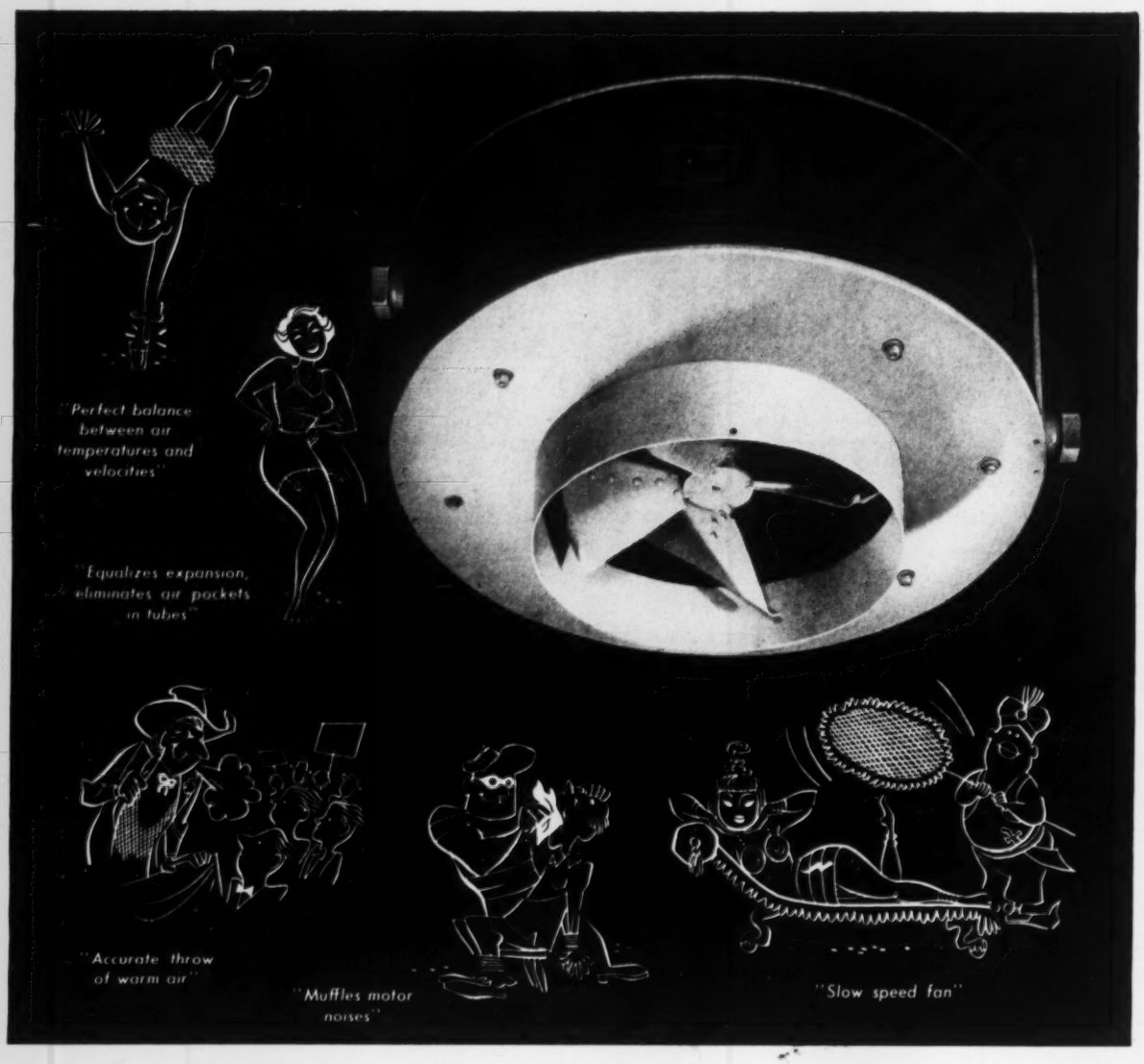
Over 70 Powers Control Panels for as many complete air conditioning systems are used at UN. Gauges on each panel indicate the position of controls.

PHOTOS BELOW: (1) Translators in Air Conditioned Glass Booths (2) Security Council Chamber (3) Trusteeship Council Chamber (4) Economic and Social Council Chamber.

UNATIONS PHOTOS



EZRA STOLLER PHOTOS


"Perfect balance between air temperatures and velocities"
"Equalizes expansion, eliminates air pockets in tubes"
"Accurate throw of warm air"
"Muffles motor noises"
"Slow speed fan"

How To Solve Your Space Heating Problems

Put in Dunham Vertical Discharge Unit Heaters and get *all* the warm air you need, *where* you need it, at temperatures that are never too low or too high. What's more, you can hang this heater in a few minutes—without putting any "support strain" on piping.

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Bulletin 1301-2 tells how sturdy, longer lasting Dunham Unit Heaters can solve your space heating problems. Full data on sizes, construction, capacities. For your free copy please write: C. A. Dunham Company, 400 W. Madison Street, Chicago 6, Illinois.

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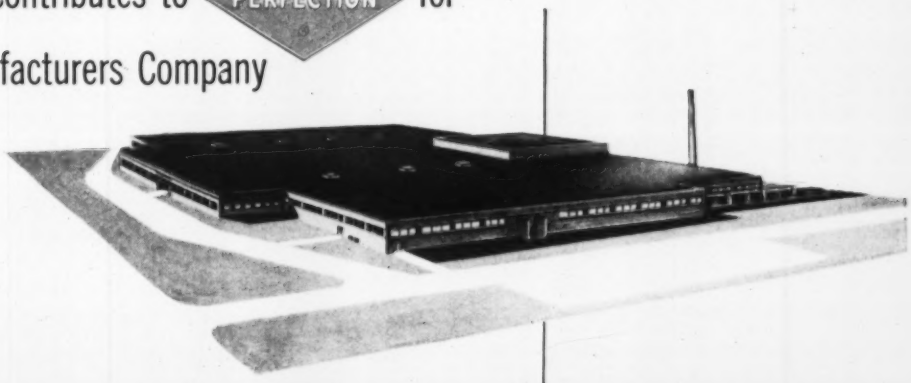
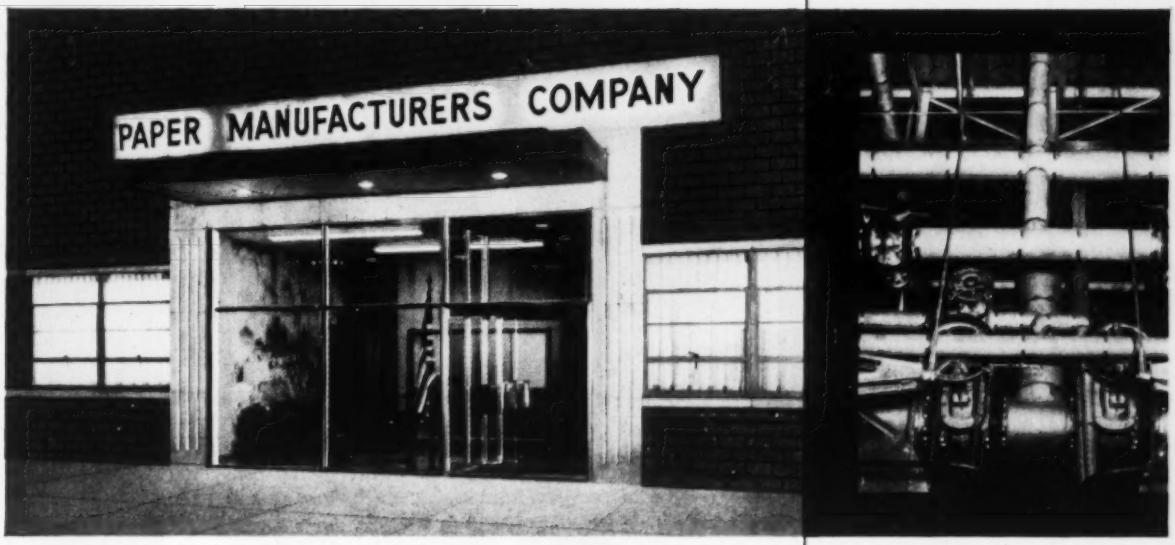
SPANG CW STEEL PIPE

contributes to PERFECTION for

Paper Manufacturers Company





Quality control is essential to Paper Manufacturers Company's production of its *Perfection* line of specialty papers. A leading paper converter, PMC produces a first quality line of paper rolls for teletype, adding and calculating machines, as well as a wide variety of gummed and heat seal papers.

Quality-consciousness naturally led to the specification of Spang CW Steel Pipe for PMC's up-to-date Philadelphia plant. There Spang CW carries the load . . . in heating, plumbing and air conditioning lines, plus special lines for processed steam, chilled water, compressed air, and high and low viscosity oils.

In the production of Spang CW Steel Pipe, too, *quality control* plays a key role. Close temperature limits, rigidly adhered to . . . the most modern production machines and control devices . . . strict inspection during every operation—all contribute to Spang CW's high standard of quality and reliability, make it easy to cut, thread and bend. Small wonder that Spang CW is consistently the first choice of quality conscious Owners, Architects and Engineers—and of smart contractors as well.

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General Contractor: **Joseph Ney Industrial Operations, Inc., Indianapolis, Indiana**

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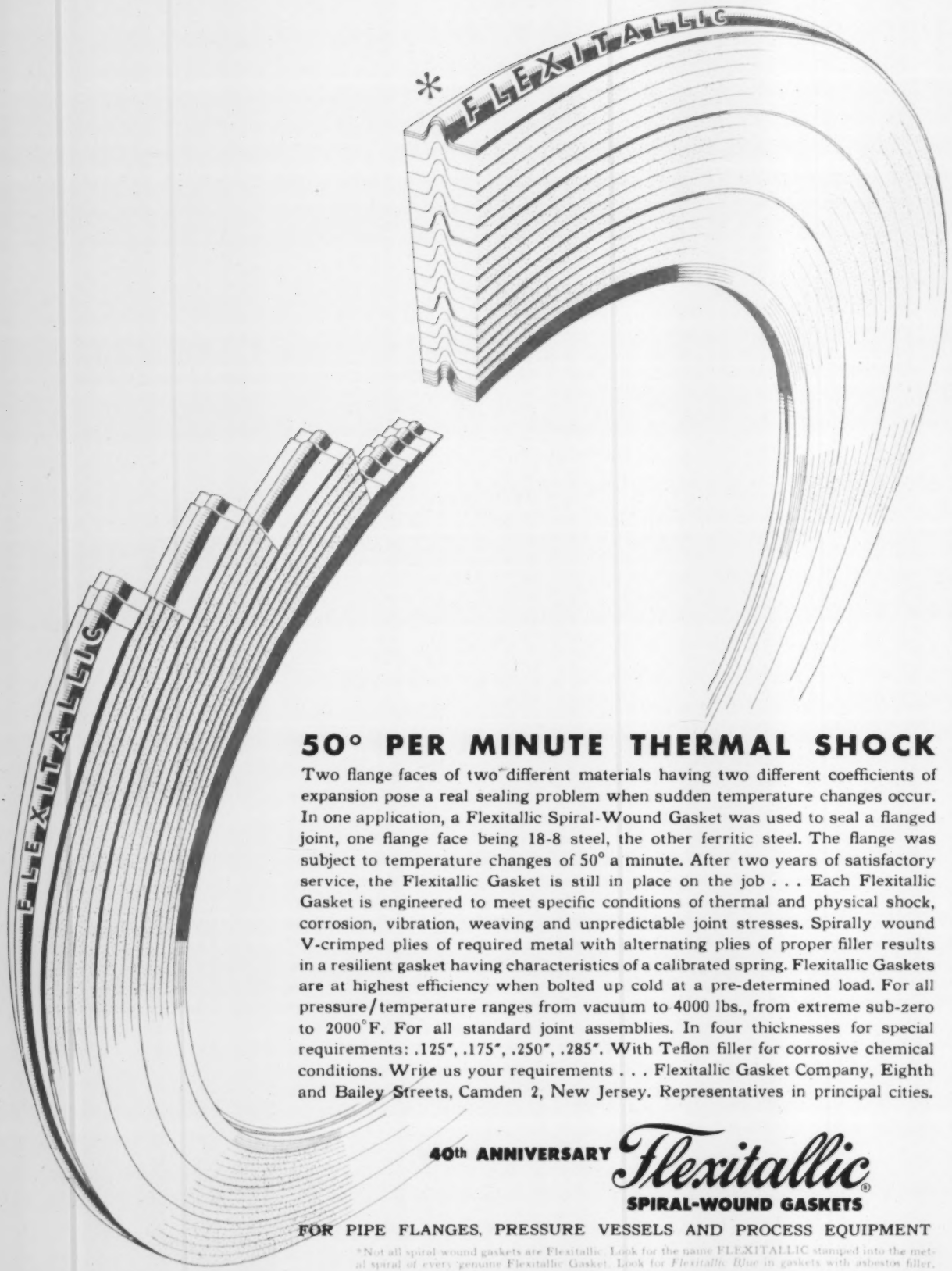

50° PER MINUTE THERMAL SHOCK

Two flange faces of two different materials having two different coefficients of expansion pose a real sealing problem when sudden temperature changes occur. In one application, a Flexitallic Spiral-Wound Gasket was used to seal a flanged joint, one flange face being 18-8 steel, the other ferritic steel. The flange was subject to temperature changes of 50° a minute. After two years of satisfactory service, the Flexitallic Gasket is still in place on the job . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a pre-determined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities.

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SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

There's wall space galore...

When the heat's in the floor!

The prime purpose of a heating system is to heat, of course, and radiant panel heating does that superbly. But these modern heating systems have much more to commend them from a woman's point-of-view. And what women want, men get for them.

Because the heating panels of steel pipe are concealed beneath the floors or in the walls or ceilings, every inch of wall and floor space becomes available for use and decoration. Rooms *seem* larger, as a result, and furniture can be positioned in many more ways for complete decorative freedom. Women love that, just as they appreciate the greater cleanliness because there are no drafts, blasts, or hot or cold spots to cause wall streaks and dirt deposits.

So, more and more, architects, builders, and plumbing and heating contractors are planning, specifying and installing "invisible" heating (as the ladies call it!), utilizing the natural advantages *steel pipe* offers for radiant panel systems.

They know that steel pipe has demonstrated its durability through more than 60 years of performance in hot water and steam heating systems. They know that, to the advantage of economy, may be added the factors of formability and weldability essential to satisfactory fabrication of coils and grids.

Yes, *steel pipe* is *first choice* . . . for radiant heating, snow melting and other applications, the most widely used *pipe* in the world!

Steel Pipe is First Choice

A free 48 page color booklet "Radiant Panel Heating with Steel Pipe" is available. Write for your copy.

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

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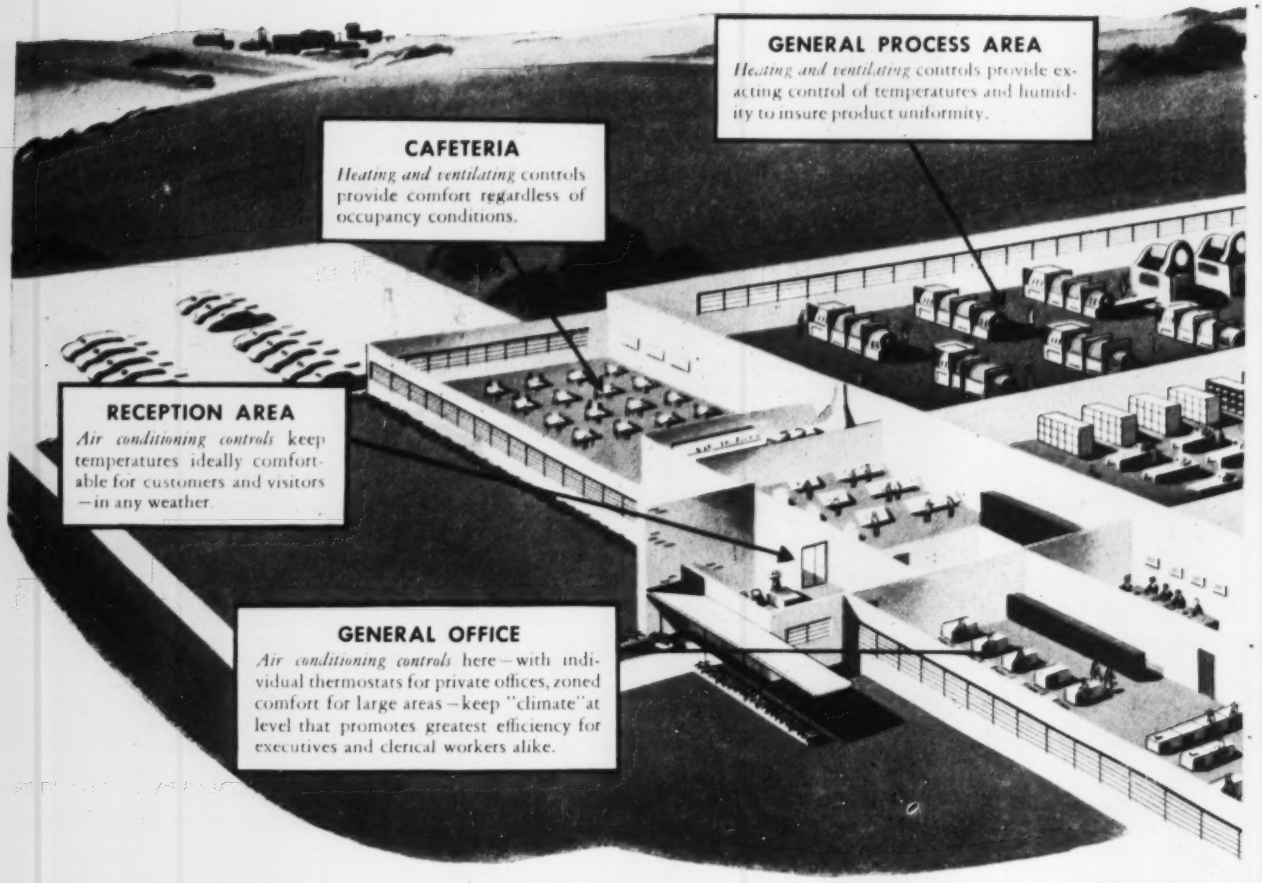

GENERAL PROCESS AREA
Heating and ventilating controls provide exacting control of temperatures and humidity to insure product uniformity.
CAFETERIA
Heating and ventilating controls provide comfort regardless of occupancy conditions.
RECEPTION AREA
Air conditioning controls keep temperatures ideally comfortable for customers and visitors —in any weather.
GENERAL OFFICE
Air conditioning controls here—with individual thermostats for private offices, zoned comfort for large areas—keep "climate" at level that promotes greatest efficiency for executives and clerical workers alike.

How Honeywell Customized Temperature Control Can Raise Industrial Efficiency

Take two of the most important factors in business today: employee work-output and product quality.

There's good evidence that on both counts the efficiency of a plant could be considerably improved by proper installation of Honeywell Controls.

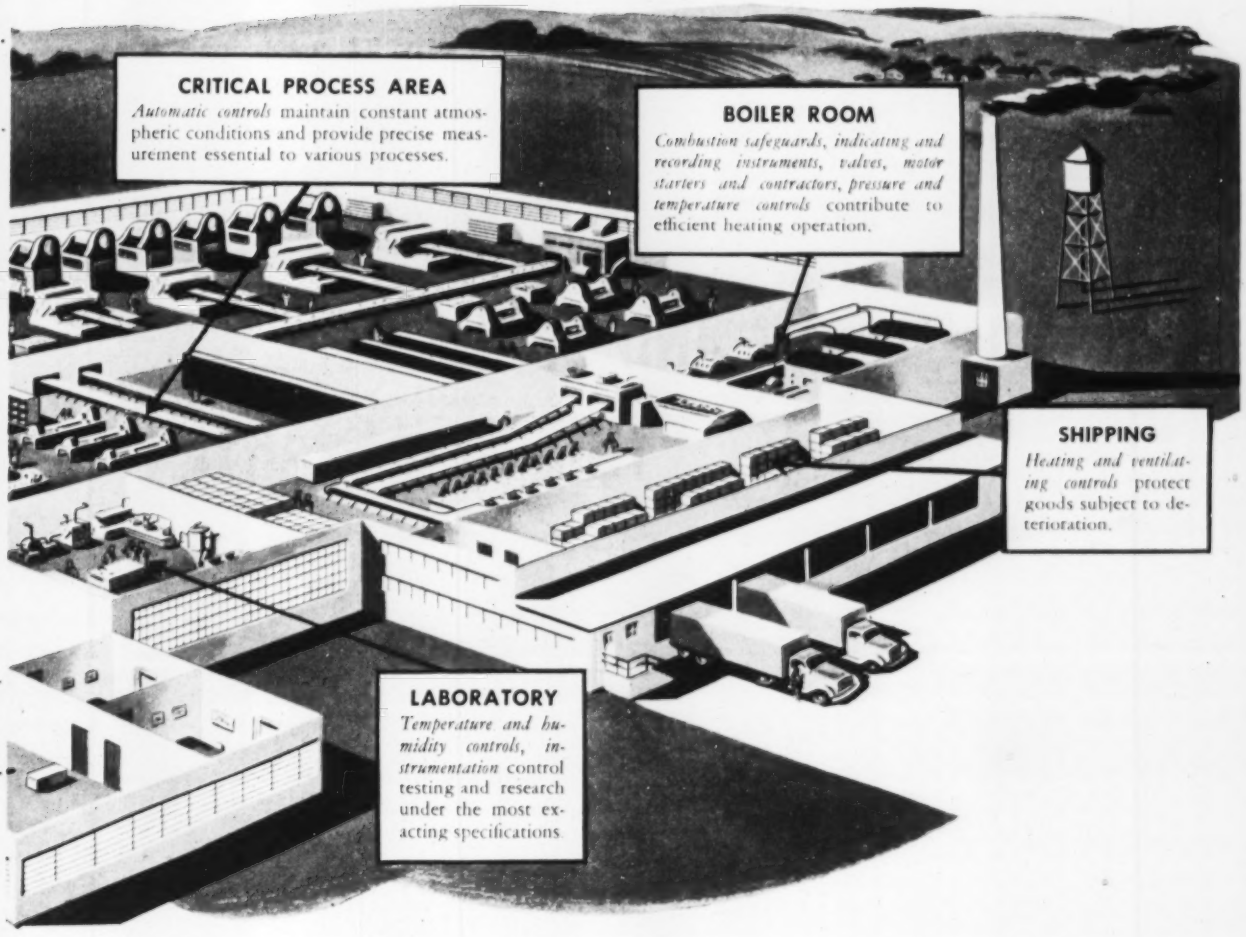
As for the amount of work employees do . . . scores of plants throughout the country have greatly boosted efficiency—by protecting workers' health, increasing their comfort, making them happier.

One of the primary ways this was done was through the use of Honeywell Customized Temperature Control installations in areas like those above. By compensating for such varying factors as weather, exposure, occupancy, internal heat sources and type of building construction, Honeywell Controls have greatly improved working conditions.

Or consider the realm of product quality . . .

Honeywell control installations in industrial centers have helped improve products, often have made possible a much greater degree of uniformity. These controls for temperature, humidity and process instrumentation are in daily use by industries as divergent as pickle packers and uranium processors, paper manufacturers and steel fabricators.

And in many cases, Honeywell Customized Control installations are saving businesses thousands of dollars yearly through more economical use of fuel.


CRITICAL PROCESS AREA
Automatic controls maintain constant atmospheric conditions and provide precise measurement essential to various processes.
BOILER ROOM
Combustion safeguards, indicating and recording instruments, valves, motor starters and contractors, pressure and temperature controls contribute to efficient heating operation.
SHIPPING
Heating and ventilating controls protect goods subject to deterioration.
LABORATORY
Temperature and humidity controls, instrumentation control testing and research under the most exacting specifications.

For Comfortable, Even Temperature in New or Existing Buildings—of any size—Use Honeywell Customized Temperature Control

Whether it's a factory, school, office, hospital, apartment, store, garage — or any size building — new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate" — and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design. Then, too, when it comes to performance, Honeywell-built controls assure years of trouble-free operation. And they're backed by the finest service organization in the controls industry.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

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First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-4-58, Minneapolis 8, Minnesota

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for motors requiring a reduced starting current

SAVE MONEY AND SPACE WITH THIS NEW STARTER

It will pay you to install these new Part Winding Magnetic Controllers to start any squirrel cage motors having two separate (parallel windings, Y-connected. They will supply a reduced voltage starting characteristic, so frequently required on refrigeration compressors and large fan drives.

Cost of starting equipment can often be reduced by using part winding starters in place of the more expensive auto-transformer, primary resistor or reactor starters. They require only half the space of other types of reduced voltage starters with the same horsepower rating. Closed circuit starting insures minimum line disturbance and lamp flicker.

Bulletin 4340 starters are available in NEMA sizes 2 to 5 PW, maximum ratings 400 hp, 550 v, 60 cy. For complete details, write to Ward Leonard Electric Co., 24 South Street, Mount Vernon, New York. 3.8

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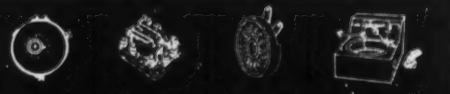
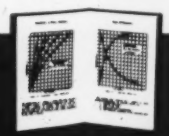


Result-Engineered Controls Since 1892



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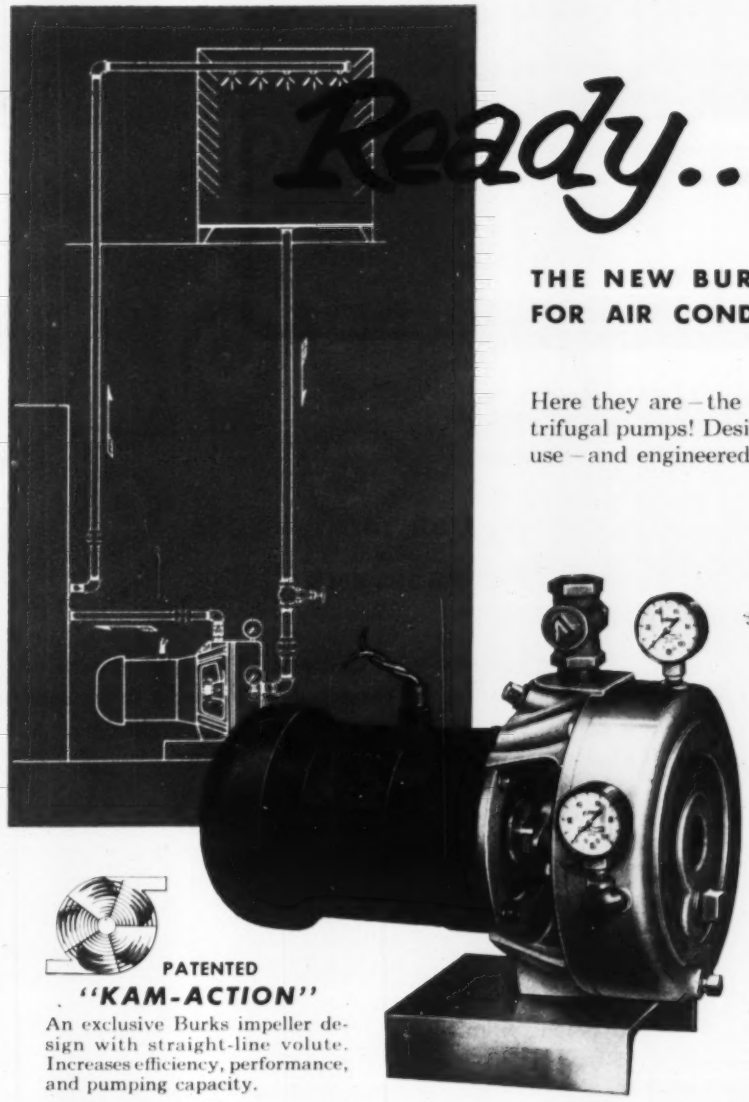
THE NEW BURKS IHV SERIES PUMPS FOR AIR CONDITIONING APPLICATIONS

Here they are—the great new Burks IHV Series Centrifugal pumps! Designed especially for air conditioning use—and engineered for highest possible efficiency.



- Can be used either horizontally or vertically—without any mechanical changes.
- Patented "Kam-Action" impeller-volute combinations.
- Full length solid stainless steel shaft. Assures perfect alignment of motor, shaft and impeller.
- Balanced bronze impeller means smooth, quiet operation.
- Available in sizes from ¼ hp. through 5 hp.—single and 3-phase.
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An exclusive Burks impeller design with straight-line volute. Increases efficiency, performance, and pumping capacity.

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DECATUR PUMP COMPANY

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BURKS IHV SERIES PUMPS

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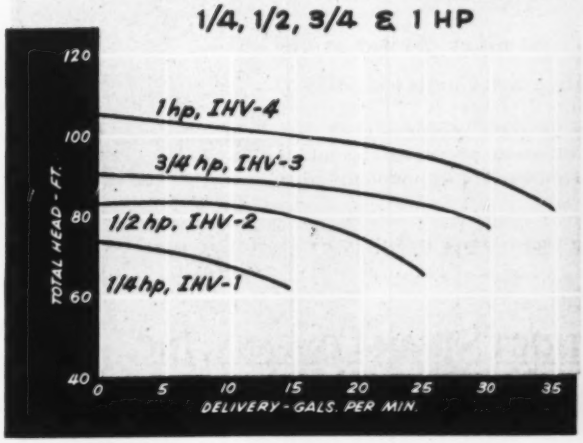
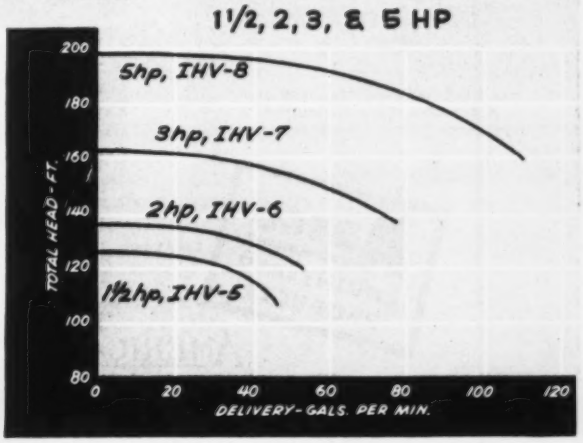
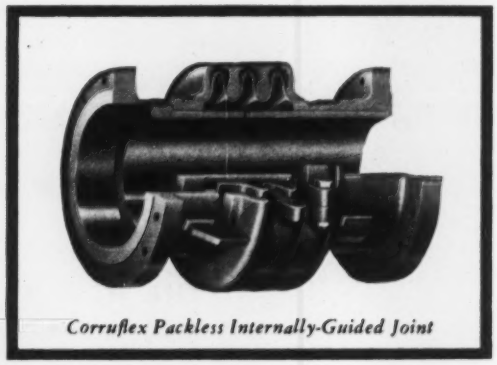


1½, 2, 3, & 5 HP





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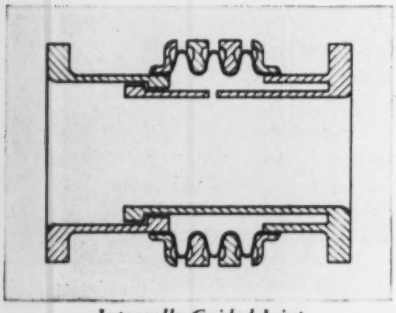
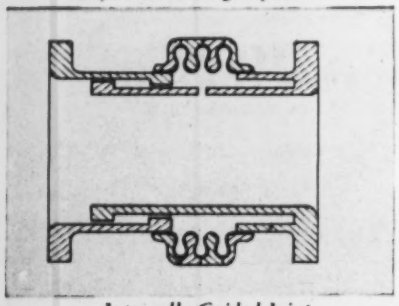
MASTERPIECE OF ADSCO ENGINEERING

Corruflex INTERNALLY-GUIDED EXPANSION JOINT PROVIDES RIGIDITY IN SPECIAL PIPING PROBLEMS



Internally-Guided Joint Before Absorbing Expansion



Internally-Guided Joint After Absorbing Expansion

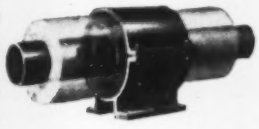
One of many reasons why Corruflex Packless Expansion Joints are so widely used by progressive engineers is the completeness of the Corruflex line. There is a Corruflex joint to absorb pipe expansion under *any* piping condition.

Suppose an engineer wants a joint which provides rigid construction against all movement except axial movement. ADSCO has the perfect solution — the Corruflex Internally-Guided Expansion Joint. No maintenance required because it is packless. Joint is built with an internal sleeve of heavy wall construction for effective guiding. Inner end of sleeve has a guide ring riding on a machined bore to insure true axial movement. Limit stop prevents the joint from being extended beyond its predetermined limit.

ADSCO makes the most complete line of expansion joints of any manufacturer in the world. That means complete engineering! Come to ADSCO for the *right* joint.

Don't let pipes get out of line

Use ADSCO Alignment Guides with ADSCO Expansion Joints. Cylinder is 12" long in all sizes, permitting pipe movement of 10". Damage to insulation prevented by ample clearance between guiding cylinder and pipe.



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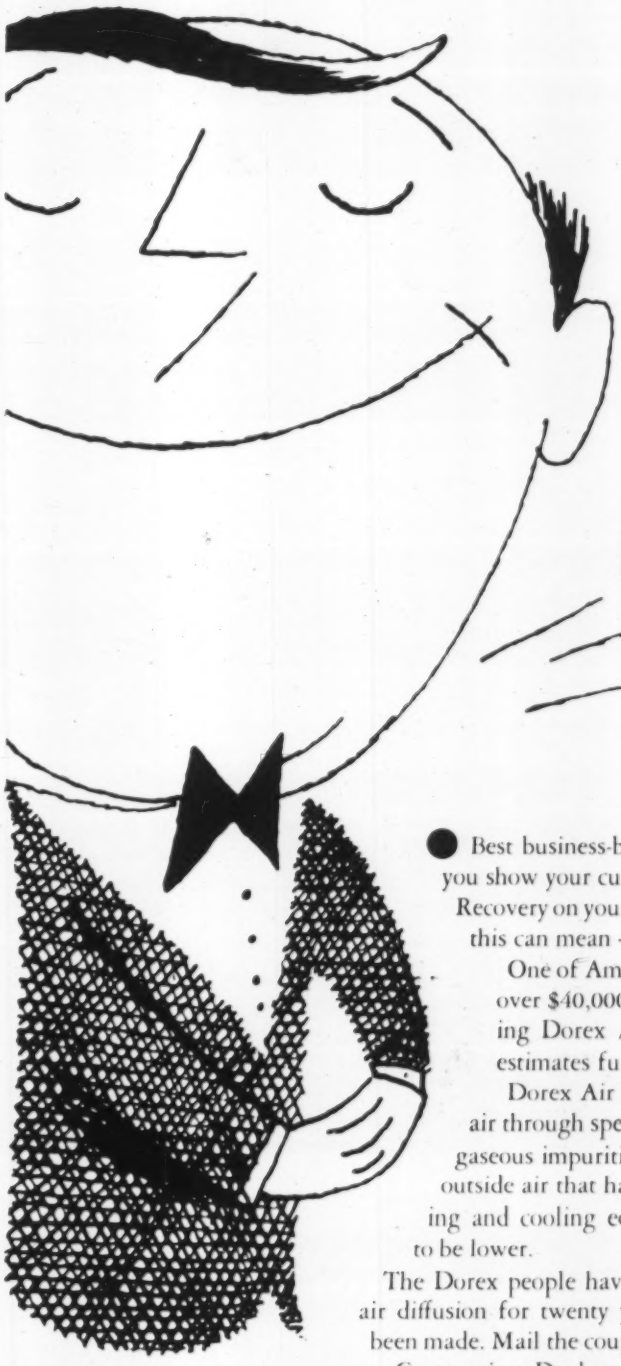
AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877



You'll LOVE this boost for your business

● Best business-booster we know is the good will that comes when you show your customers a worth-while saving. So specify Dorex Air Recovery on your air cooling and heating jobs. As an example of what this can mean —

One of America's great manufacturing plants has already saved over $40,000 on the cost of boilers and other equipment by making Dorex Air Recovery part of its heating system . . . and estimates further savings of about 2,500 tons of coal a year.

Dorex Air Recovery "manufactures" *fresh* air by passing *used* air through specially activated carbon that removes all odorous and gaseous impurities. This reduces by about two-thirds the amount of outside air that has to be taken into the system. That's why less heating and cooling equipment is needed, why operating costs are sure to be lower.

The Dorex people have been experts in air recovery, air purification and air diffusion for twenty years. More than 10,000 Dorex installations have been made. Mail the coupon today for full information. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR ENGINEERING CORPORATION

dorex® air recovery

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Please send me, without obligation, full information on Dorex Air Recovery.

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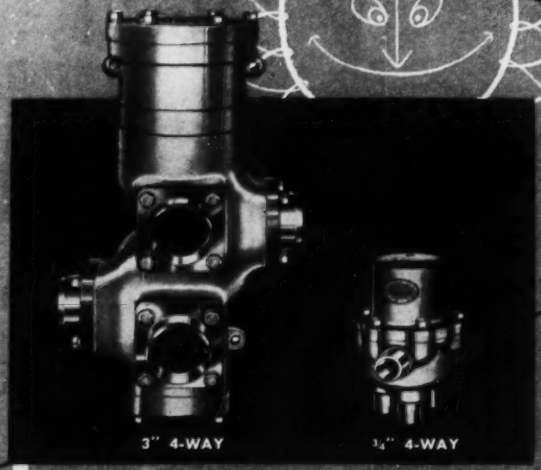

NOW! Heat or refrigeration from ONE system

with **ALCO**

4-WAY REVERSING VALVES

field-tested 6 years

You flip a switch and the 4-WAY VALVE reverses the cycle . . . converts the evaporator to a condenser (or vice versa) for heat or refrigeration.

MANY APPLICATIONS:

Heating and air-conditioning of homes and large buildings.

Hot gas defrost in commercial refrigeration installations.

Product temperature control in railcars and trucks.

Tight seating, positive shifting. Made in sizes ranging from ¾" to 3" connections.

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Designers and Manufacturers of Thermostatic Expansion Valves, Evaporator Pressure Regulators, Solenoid Valves, Float Valves, Float Switches

5606

Serving the Heating Industry since 1926

Yula .... a complete line of dependable HEAT EXCHANGERS

Yula-trol
Relay box and alarm

Get this vital DOUBLE* PROTECTION for your oil burner installations with...

Yula-trol AND **Yula** "YT" "U" TUBE
FUEL OIL DETECTOR — FUEL OIL HEATER

- **Protects system from serious damage, in case of oil leak in the Pre-heater, by shutting off oil burner, sounding an alarm, flashing on a red light.**
- **Acts as a Low Water Cut-off**

RESULT: Heating system protected at low cost

Yula "YT" "U" Tube Heater and Probe
Patented 2,610,267

Approved
by the New York City Board of Standards and Appeals No. 367-50-S.A.

Like all Yula equipment, the Yula-trol and Yula "YT" "U" Tube Heaters provide the maximum in efficient, economical operation at lowest possible cost. Get Yula efficiency...get Yula "Double Protection".

TYPE "M" MIXING VALVE
Automatically mixes hot and cold water and other fluids. Delivers it at any predetermined constant temperature.

Other Yula Products

INSTANTANEOUS HEATERS

Ideal for domestic and industrial applications where large volumes of hot water or other solutions are needed for service water supply or process work.

CONVERTERS

. . . fully guaranteed. For water in tubes, steam in shell or water to water applications. "U" tube bundle construction simplifies cleaning.

DRY EXPANSION FREON COOLERS

. . . designed for air conditioning, refrigeration, industrial and process uses for cooling water or other liquids.

A. S. M. E. CONSTRUCTION

Yula carries a Complete Line. Yula's Engineering Staff is at your service.

YULA WATER HEATERS, INC.

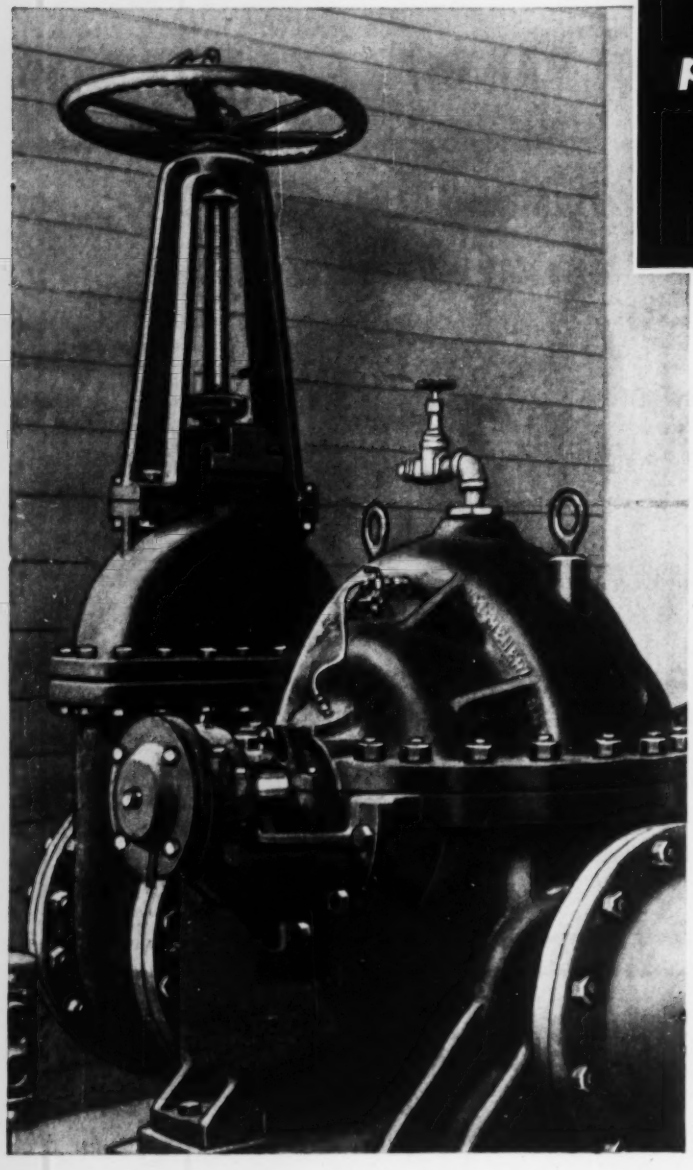
166 WEST 225th STREET, NEW YORK 63, N. Y.

MEMBER FUEL OIL AND WATER HEATER MANUFACTURERS ASSOCIATION

For complete information write Dept. HP

"Buffalo"

Tips on Better Pumping



"Buffalo" Type SL Double Suction Pump. For Engineering data, write for Bulletin 955.

The cheapest pump is the one that lives up to expectations

First cost is the smallest part of what the wrong pump could cost you, once installed. If it fails to meet capacity and pressure requirements, it means costly replacement or supplementary pump units. Or if the pump is not built to stand up on the job, the owner is in for more expense and dissatisfaction.

"Buffalo" Pumps cost a little more to build — and by the same token, a lot less to run. Only the finest workmanship and materials go into them. Impellers, shafts, stuffing boxes and bearings are oversize. Water passages are simply formed. All parts are readily accessible. And whether you need a boiler feed pump to handle 300 gpm at 1400' head, a water pump to handle up to 10,000 gpm, or a single suction pump for, say, zone air conditioning, "Buffalo" makes the right model and size for the job. What's more, it's load-tested before delivery, and you can be sure of performance right up to rated capacity. On your next job, make it "Buffalo" and see.

"Buffalo"

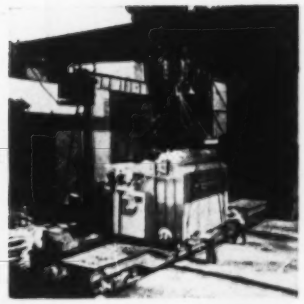
BUFFALO PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

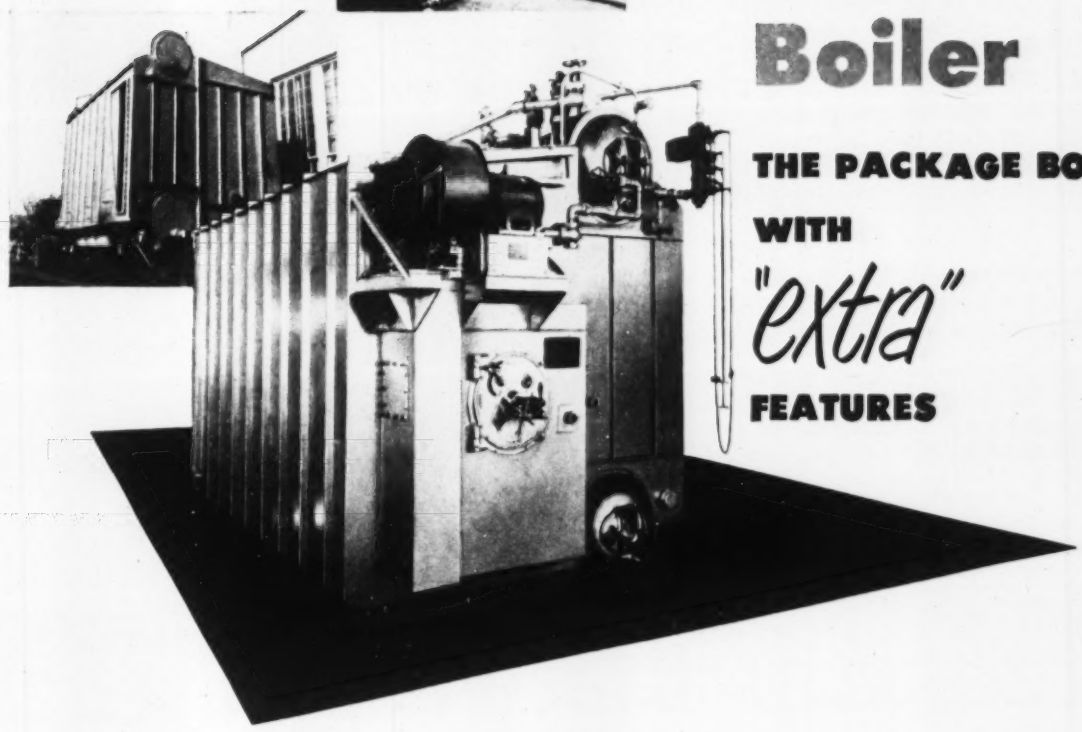
Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



the VP Boiler

THE PACKAGE BOILER WITH "extra" FEATURES



Most of the water-tube "package" boilers available today look very much alike. As a matter of fact, in some respects they are alike.

The prospective purchaser's job is to discover which of the several package boilers now available offers a combination of features and advantages that adds up to the "best buy".

Consider, then, the fact that the C-E Package Boiler, Type VP, has *all* the design features offered by any of its contemporaries *plus* the important extra features described at the right.

VP Boilers are available in capacities from 4,000 to 30,000 lb of steam per hr; pressures to 250 psi. Send for Bulletin V-18.

FULLY WATER-COOLED FURNACE – Even the front or "burner" wall is protected, except in three smallest sizes. Has higher ratio of furnace-wall cooling to furnace volume than any boiler of its size and type. Assures rapid and efficient heat absorption, lower gas temperatures entering convection bank, reduced tendency to slag formation. Minimizes furnace maintenance.

LARGER LOWER DRUM – The large lower drum, 30" in diameter, permits simple, symmetrical tube arrangement; provides easy access when necessary for washing down or for inspection; greater water storage capacity facilitates handling fluctuating loads.

CENTRIFUGAL FAN – This type of fan is more efficient, operates at lower speed and is quiet in operation. The average noise level is less than half that of typical high-speed blowers used on most boilers of this type. Low noise level is particularly advantageous in confined space and in such installations as hospitals.

SIMPLE BAFFLE ARRANGEMENT – Minimum changes in direction (no baffle at all in convection bank in larger size units). Gives lower draft loss. Simplifies soot blowing. Cross-flow of gas with elimination of dead pockets gives maximum heat pick-up. Water-cooled baffle in intermediate sizes insures minimum maintenance.

B-6528

COMBUSTION ENGINEERING—SUPERHEATER, INC.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

C-E

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

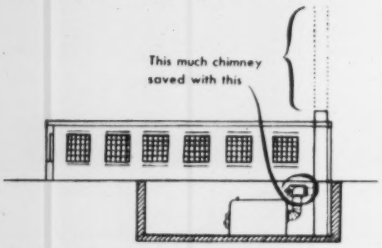


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

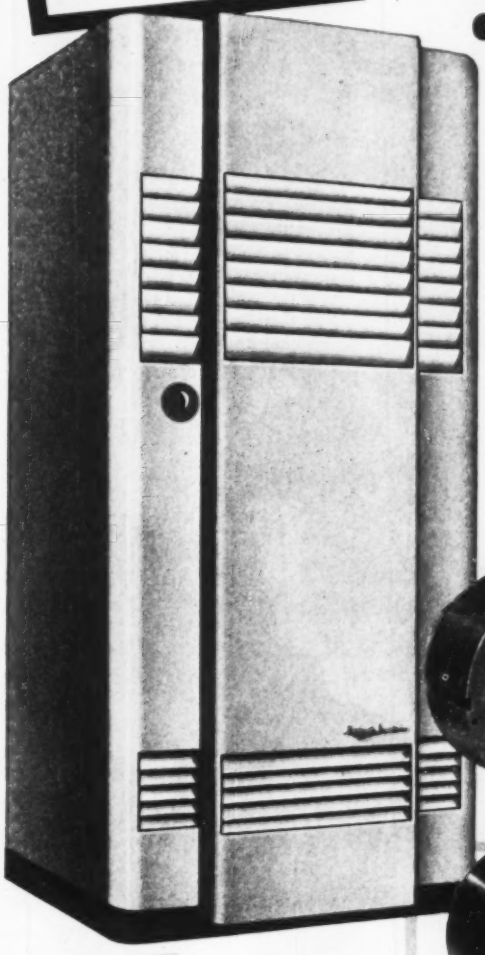
The Moving Airstream Touches the Worker for only a few Seconds at a Time
Perfect Comfort
NO SICKENING HOT BLAST!
THAT is the big difference between most unit heaters and the WING Revolving Heater. The soft airstream from the slowly revolving discharge outlets creates a warm, gentle, yet live sensation of comfortable well-being that is without equal for keeping workers contented and productive.
. . And in the Summer time with the steam turned off and the fans on, these same revolving discharge outlets will create a pleasing, cooling effect on the hottest days.
Write for Bulletin HR-6
Wing
L. J. Wing Mfg. Co.
Linden, New Jersey
Factories: Linden, N. J. & Montreal, Can.
In Europe: Etab. WANSON, Brussels, Belgium
UNIT HEATERS
FANS
BLOWERS
DRAFT INDUCERS
TURBINES

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

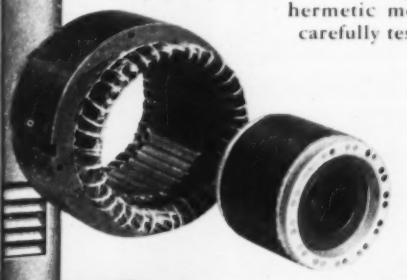
Insure your sealed units against motor failure... use Wagner Hermetic Motors

Hermetically sealed compressors for air conditioners and refrigerating equipment are rapidly gaining preference because of the great convenience they offer to users of the equipment—there is nothing to oil or adjust, no belts to wear out.

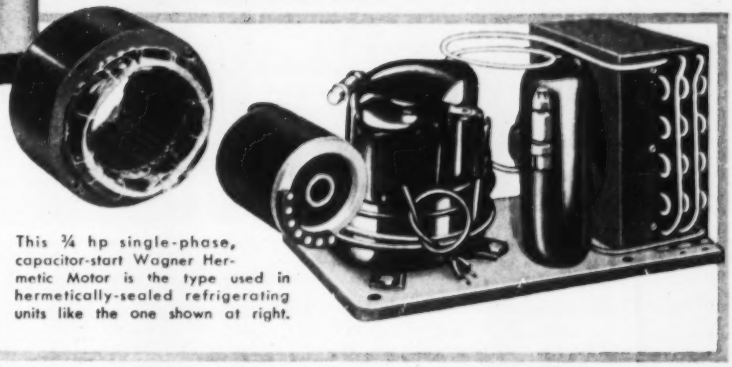
Wagner can provide hermetic motors to power *your* equipment. Wagner hermetic motors are available for both polyphase and single-phase applications. These hermetic motors, like all Wagner Motors, are backed by more than sixty years of motor building experience. Each Wagner hermetic motor is precision-built and carefully tested.



This compact, self-contained air conditioning unit, that may be located in or out of the air conditioned space, is typical of many such units powered by Wagner Hermetic Motors.



Wagner Hermetic Motor of the type used in self-contained air conditioners. This 7½ horsepower polyphase squirrel-cage motor is especially designed for use in sealed refrigeration units.



This ¾ hp single-phase, capacitor-start Wagner Hermetic Motor is the type used in hermetically-sealed refrigerating units like the one shown at right.

Consult a Wagner engineer on your motor applications. Call the nearest of our 32 branch offices, or write us for full information.

Wagner Electric Corporation
EST. WE 1891

M53-5

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

THEY ALL GO FOR TACO'S BIG RUGGED MOTOR AND BIG CAPACITY CIRCULATOR
TACO VENTURI
TACO AIR SCOOP
TACO VENT
TACOMATIC
CO TEMPERING VALVES
They sure stand up TACO CIRCULATORS HAVE BIG RUGGED MOTORS
WOW! LOOK AT THOSE BIG TACO
TACO

IMPELLER IS *CAST IN ONE PIECE* FOR LONG LIFE!

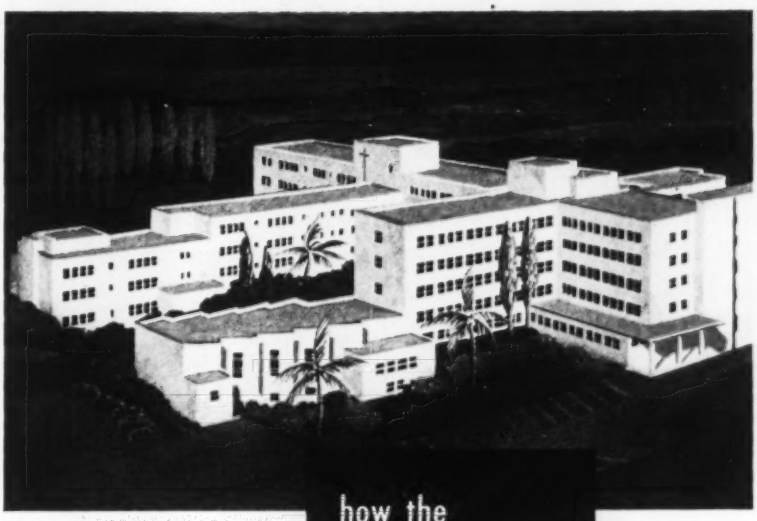
***SPECIALLY SELECTED MOTOR* FOR QUIETNESS!**

***LOWEST OPERATING COST* RESULTS FROM ITS AMPLE CAPACITY!**

Taco

Better Heating-Better with Taco

TACO HEATERS, Incorporated • 137 SOUTH STREET, PROVIDENCE 3, R. I.



St. Francis Hospital in Lynnwood, California, selects the York High Velocity Double Duct System . . . the advanced system that permits individually-controlled air conditioning in rooms and wards.

• • •

Hugh Davies, Architect
Pozzo Construction Co., Contractors
Al Kleiber, Engineering Consultant

how the St. Francis Hospital can help solve your air conditioning problems . . .

You may have only a passing professional interest in the air conditioning problems of one of the world's most modern hospitals.

But this new, major development points out a solution to your air conditioning problems . . . *no matter what they are!*

You see, York Engineers work with the industry's *widest* range of equipment. They do not have to compromise—and try to fit a rigid system to a building or fit the building to a system.

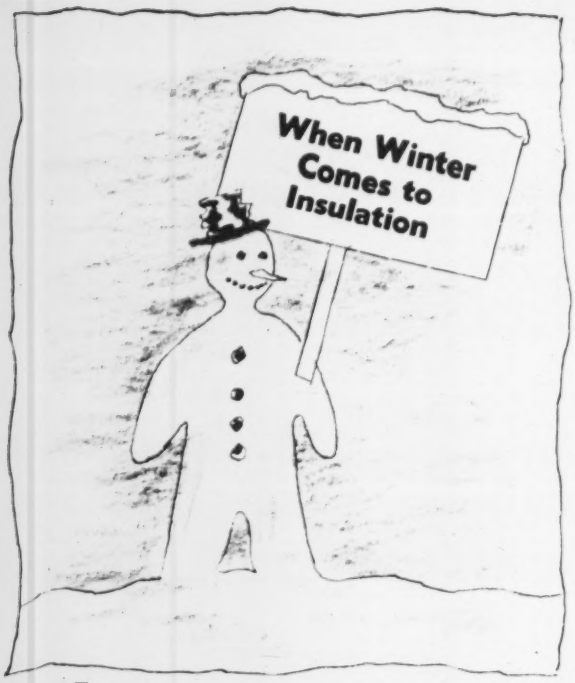
They can recommend with broad impartiality, the installation that *precisely* suits the particular requirements of the building you are air conditioning. The result? Better performance, longer life at low initial and operating cost. No wonder York has installed more air conditioning and refrigeration capacity than all the others!

There is a York Engineering Office near you. The number is in your Classified Telephone Directory. A consultation with a York Engineer incurs no obligation, of course. It can lead to important savings in time, money and worry for you, as it has for so many others. Or write to York Corporation, York, Pennsylvania.

• • •

In every major trading center there is a York Engineering Office with men skilled in the arts of engineering, contracting, construction and service. They are constantly backed by continual factory research and product development in one field exclusively—air handling and mechanical cooling! They are at your service always!

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885



Insulation for winter warmth and fuel conservation can be more efficient and also provide coolness and comfort in summer. It can reduce original and operating costs of air cooling equipment as well as of heating plants. A building really shielded from the summer sun's radiation is considerably cooler, not only by day but also at night. A building properly shielded from winter heat loss heats up faster, is more comfortable, requires less fuel, and stays warm longer at night when furnaces are turned down.

Choosing insulation can be a thoughtless, perfunctory product of inertia or a scientific selection based on physical needs, financial considerations and performance. Readily available studies and tables show the thermal factors, permanency, and permeability to water vapor of different materials, and to what extent they foster or prevent destructive condensation.

Gold, silver and aluminum sheets have the best ratings in all these categories. But aluminum may be had at a very low cost in the form of pre-fabricated multiple accordion sheets which automatically create reflective air surfaces and spaces when installed.

Multiple accordion aluminum has high rejection and low projection of heat rays; low conduction because of preponderant air spaces and slight mass. It blocks convection because of compartmented layers. To vapor, it has zero permeability. It is practically non-condensation-forming. Slight mass also prevents unwanted heat storage.

Commercially, multiple accordion aluminum is available as Infra Insulation, Types 6, 4 and 4 Jr. Cost of Type 6, material with labor, in new construction between wood joists, is about 9¢ a sq. ft.

Read the detailed development of the points made above, consult the charts of thermal factors and of relative reflectivities and emissivities; benefit from pertinent, valuable information in Schwartz's "Simplified Physics of Vapor and Thermal Insulation." Use the coupon to get a FREE COPY.

INFRA THERMAL FACTORS. TYPE 6

Up-Heat	**C.089, R 11.23**	**=**	**4 3/5" dry rockwool**
Wall-Heat	**C.073, R 13.69**	**=**	**5 5/8" dry rockwool**
Down-Heat	**C.044, R 22.72**	**=**	**9" dry rockwool**

INFRA INSULATION, INC.

525 Broadway, New York, N. Y. — WORTH 4-2241

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525 Broadway, N.Y., N.Y. Dept. H-4
Please send FREE "Simplified Physics of Vapor and Thermal Insulation."

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☐ Send Prices of Infra Insulations ☐ Send Sample

THE EDITOR'S PAGES

"THANKS A MILLION" say we in answer to a letter from a contractor, which arrived just as we were trying to fill this space. "We offer you congratulations on a fine journal," the letter says. "We keep your Directory Numbers in a permanent file in our office, and they are referred to almost daily. Keep up the good work."

"OUTLOOK FOR 1953 IS GOOD"

AMERICAN RADIATOR & Standard Sanitary Corp. reported net income for 1952 of $18,180,655, equal to $1.78 a common share, against $22,027,024, or $2.16 a share in 1951.

Sales last year of $277,153,664 compared with 1951's record $305,111,668, President Theodore E. Mueller told stockholders in the annual report.

Noting that the drop in sales took place in the first half of 1952, Mr. Mueller said sales in both the third and fourth quarters of last year topped the like 1951 quarters.

"The outlook for 1953," he observed, "is for a good market for our products; but one in which the increased productive capacity of the heating and plumbing industry will be an important competitive influence."

NEW SALES, OTHER RECORDS ESTABLISHED

THE TRANE CO., manufacturer of air conditioning, heating, ventilating and heat transfer equipment, established new records in sales, earnings and dividend payments in 1952, D. C. Minard, president, has reported.

Consolidated net sales were $41,982,317 compared with $38,576,455 in 1951. This was the 10th consecutive increase since 1943, when sales were $8,929,877. Net income was $2,277,473, compared with $2,159,712 in 1951. Income per common share equaled $3.80, compared with $3.60 in 1951.

Cash dividend payments were $1.50 per share compared with $1.25 in 1951.

Mr. Minard said that the company spent $1,230,228 for additional manufacturing space and new machinery and equipment during 1952. The increased facilities will be used partly for the production of new heating, heat transfer, and refrigeration products developed during the year. However, strong emphasis is being placed on improved methods and processes for lowering manufacturing costs.

A new laboratory, begun in 1952, will more than triple the company's research facilities this year, he said.

Defense business — approximately 22 percent of the 1952 volume — is regarded as satisfactory in the sales outlook.

PREDICTS LARGE MARKET FOR AUTOMOBILE CONDITIONING

WITHIN 10 YEARS, one out of every 10 new automobiles will be equipped with air conditioning, according to P. J. Kent, executive engineer of the electrical department, Chrysler Corp. engineering division, at the national passenger car, body and materials meeting of the Society of Automotive Engineers.

Tracing the development of automobile air conditioning, Mr. Kent noted that only about 10,000 cars have been air conditioned in the past 15 years. Most of these have been equipped with mechanisms built and installed locally. He said that with major automobile companies now offering air conditioning, it will be possible to expand the market for air cooling of automobiles materially.

SEES MUCH MORE AIR CONDITIONING THIS YEAR

NEW ORDERS BOOKED by Carrier Corp. during the first three months of fiscal 1953 were 34 percent in excess of those for the corresponding period a year ago, Cloud Wampler, president, stated at the annual meeting of stockholders. He pointed out that this increase involved only normal business and did not reflect contracts for extraneous defense production.

Mr. Wampler predicted at least 50,000 air conditioned homes this year, compared to some 10,000 last year. "Larger air conditioning installations in buildings of all types should also be more numerous this year as the result of relaxation of government controls on construction," he said. He noted that relatively few new commercial structures are now being planned without air conditioning, and that there is a very definite trend toward the air conditioning of industrial plants.

"Retail sales of the air conditioning industry, which were estimated at $1¼ billion in 1952, should mount by $500 million this year to a total of $1¾ billion," he said. "This would be a gain of 40 percent in one year, as compared with a 25 percent rise in 1952 over 1951. And by 1960 total air conditioning sales at the retail level should reach an annual rate of $5 billion, assuming reasonably favorable business conditions."

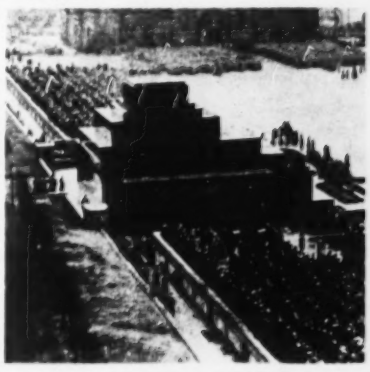
"ON THRESHOLD OF GREATEST AIR CONDITIONING DEMAND"

AT WORTHINGTON'S recent air conditioning and refrigeration distributor conference in New York, M. M. Lawler, assistant vice president and manager of the corporation's air conditioning and refrigeration division, revealed that his division's product sales for 1952 were 20 percent above 1951.

"Our air conditioning and refrigeration division had the best year in

AIR CONDITIONED TOMB

THIS PHOTO OF LENIN'S TOMB, in Moscow—where Stalin's body now also lies — was first published in the September 1935 issue of Heating, Piping & Air Conditioning. At that time, air conditioning was being installed in the tomb "to permit it to be open all day instead of but an hour each day." The marble structure was built in 1930



its history in spite of a slow start during the first quarter," Mr. Lawler said. "The removal of curbs on commercial construction early in the year, along with a sustained nationwide hot spell at the most opportune time, plus a high level of industrial expansion, all combined to make 1952 a record year."

Mr. Lawler predicted that in spite of the tremendous growth that the industry has experienced during the last five years, "we are on the threshold of the greatest demand for our goods and services that we have ever experienced."

"BOILER HEATING IS BIG BUSINESS"

THAT "MODERN BOILER HEATING" is big business — and is growing bigger — was pointed out by C. M. Baumgardner, vice president, National Radiator Co., in an address before the National Heating Wholesalers Association convention.

Approximately $626 million was the total value of all hot water and steam heating equipment sold and installed in 1952, according to Mr. Baumgardner. This figure is "at the contractor level" and includes the cost of installation of boilers, radiators, baseboards, convectors, panels, and accessories and controls used with hot water and steam heating systems.

$200 BILLION BY 1960 FOR IMPROVED TOOLS, EQUIPMENT

AMERICAN INDUSTRY will have to invest by 1960 about $200 billion — nearly as much as was invested in the last 30 years — if it is to achieve adequate output, with the working force available, to maintain our high standard of living. That was the word given by Dean E. Carson, director of business research for the B. F. Goodrich Co., in a recent address before the Philadelphia chapter of the National Industrial Advertisers Association.

Mr. Carson pointed out that studies by his company indicate the total population of the U. S. by 1960 will be 174 million, an increase of about 15 percent from 1950. This population increase will be mainly an addition to the consuming group rather than to the producing group.

To achieve more productivity, every American worker must be provided with more effective tools. These tools will cost $200 billion, compared with the $71 billion spent for new plants and equipment in the 1920's or with the $110 billion invested by industry in the 1940's, he said.

PREDICTS 450,000 PLASTIC CONDITIONER CABINETS YEARLY

DEVELOPMENT OF A new major market for large molded plastic parts was revealed last month by John L. McMurphy, general manager of the General Electric Co. plastics department, who predicted that all important makes of window air conditioners will be housed in one-piece plastic cabinets by mid-1955.

"In two years, the plastics industry will be producing conditioning cabinets at an annual rate exceeding 450,000," he declared. "G. E., itself a major producer of air conditioning equipment, estimates industrywide sales of 700,000 window air conditioners in 1955 — more than double the 325,000 units sold in 1952."

"QUOTE"

"Without any hesitancy whatsoever, we give our sincere testimony to the value of air conditioning in our church. It not only makes for comfort of the worshiper but gives a background of quietness, shutting out outside noises, which is most conducive to worship.

"For the months of June, July and August 1952, our loose change offerings, apart from budget payments entirely, increased $1154. This figure, of course, indicates an increase in attendance, since the loose change offering is gauged almost entirely by the number of people present.

"Travis Park Methodist Church would not by choice surrender its air conditioning for anything, I'm sure. Increased attendance at services of worship in the summer give the church a shot in the arm which is very healthy. There was very little change in attendance during the summer months from the regular attendance during the winter months. Our church did not slacken at all in its vigorous and active Sunday program during the summer and saw very little change in its week-day program." — KENNETH W. COPELAND, Pastor, Travis Park Methodist Church, San Antonio, Texas.

IBR HEATING SCHOOL GRADUATES 6000TH STUDENT

THE 6000TH STUDENT has been graduated from the IBR school of modern heating, according to the Institute of Boiler and Radiator Manufacturers.

A total of 110 schools have been conducted since April 1950. The students have come from 1387 cities and towns in 37 states as well as the District of Columbia and Canada.

MILWAUKEE NOW OFFERS M.E. DEGREE COURSE

FROM A ONE-COURSE school in 1903, when only practical electricity was offered, the Milwaukee School of Engineering has grown until it now offers 18 full-time courses.

Its 50th anniversary catalog lists mechanical engineering as a degree course for the first time. Heating, refrigeration, air conditioning, welding and mechanical technology — all part of the curricula for many years — serve as the beginning courses for the three mechanical engineering fields — plant engineering, metal fabrication and mechanical design.

PRODUCTS "SWEAT IT OUT" ARTIFICIALLY

INDUSTRY SPENDS millions of dollars annually testing its products against wear, abuse and a host of rugged conditions. But no products "sweat it out" any more than do various items manufactured by Minneapolis-Honeywell.

That can be taken literally, because one of the tests involves the study of the effect of perspiration on the finishes of products.

Since the chemical makeup of perspiration varies from person to person, Honeywell prefers to brew its own. Valeric acid, butyric acid, acetic acid and salt are used to make the artificial concoction.

* * * *

Questions about heating, piping and air conditioning problems are asked — and answered — each month in HPAC's "Question of the Month" department. Don't miss it!

Nature Controls the Heat in these Schools

James Solomon Russell School, Brunswick County, Va. Total square footage — 67,356. Cost — $324,870. Heating Contractors: W. J. Bloomfield & Son, Inc., Farmville, Va.

Dixon & Norman, Virginia architectural firm specializing in schools, specify Webster Moderator Systems for efficient heat in open-plan buildings fed by long steam lines.

"Nature makes the weather, let her operate the controls" — so say Dixon & Norman, Richmond architects and engineers. For comfort and economy, in all of their larger schools, they use centrally controlled, continuous flow steam heating systems.

"Many of our schools are also used for community activities," Dixon & Norman point out. "Classrooms are larger than average and auditoriums, gymnasiums and shop areas are in separate wings. Despite long steam lines, there is balanced heat distribution because the Moderator System delivers heat evenly and rapidly to every section of a building."

For information about Webster Products for school heating, call the Webster Representative or write us.

Address Dept. HP-4

WARREN WEBSTER & COMPANY

Camden 5, N. J. Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal

WEBSTER

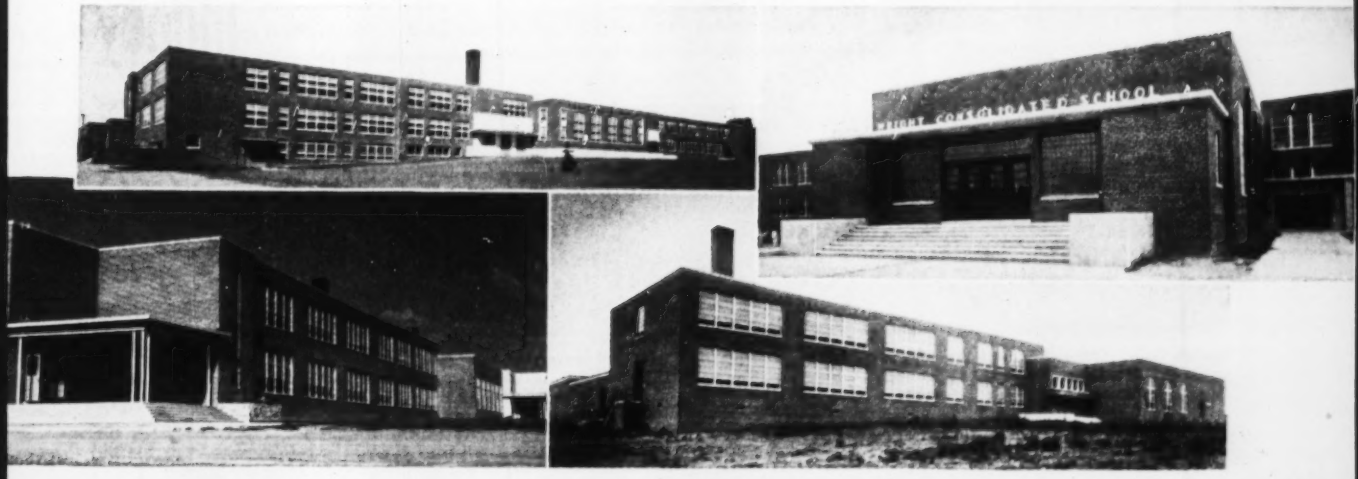
MODERATOR

SYSTEM

OF STEAM HEATING

"Controlled by the weather"

TOP LEFT: Hermitage High School, Richmond. Heating Contractors: W. H. White, Plumbing & Heating, Richmond. TOP RIGHT: John J. Wright School, Spotsylvania County, Va. Heating Contractors: W. J. Bloomfield & Son, Inc. BOTTOM LEFT: Montevideo High School, Montevideo, Va. Heating Contractors: J. H. Cothran Co., Inc., Altavista, Va. BOTTOM RIGHT: Union High School, Caroline County, Va. Heating Contractors: J. H. Cothran Co., Inc.



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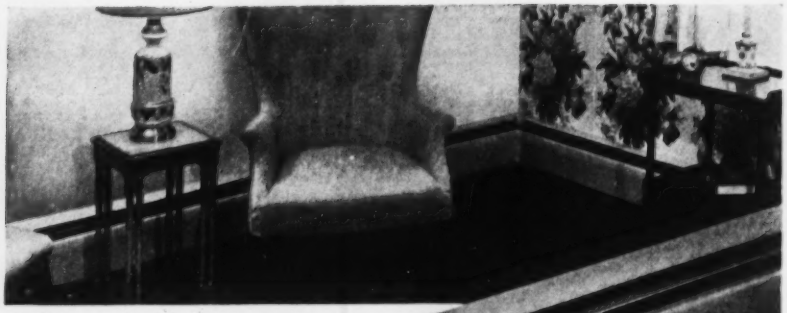
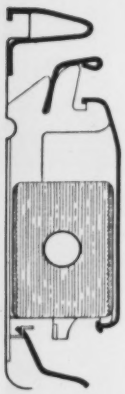
COMFORT

with an Intelligent Artistry...



NESBITT Baseboard Radiation



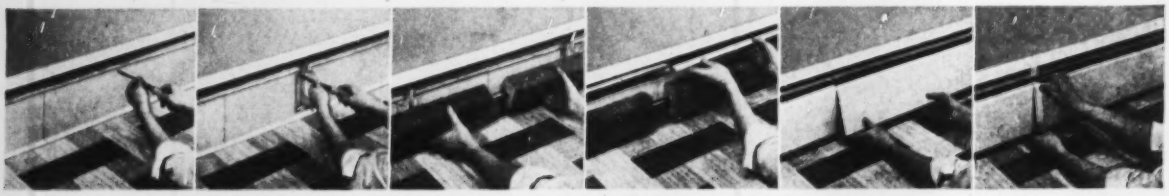
EASY TO INSTALL

PERIMETER or baseboard radiation is not a new idea . . . but Nesbitt's approach to it is. From the vantage of long experience in the field of thermal comfort, Nesbitt set out to perfect the best possible floorline convector-radiator and then to master the matter of appearance through intelligent artistry. The result is an uninhibited product—Nesbitt Baseboard Radiation—with an adequate capacity in the fin-and-tube element (4 sq. ft. per lin. ft.) to heat the average room with only one wall length—in a streamlined enclosure that fits agreeably in any decor and appeals to the modern homemaker.

Assembled, packaged lightweight units of standard lengths are available from wholesalers, with accessories and dampers as required. Ingenious helps for easy installation, including mated tube ends for jointing without fittings, save today's most expensive commodity—time. Designers and contractors who are cost-conscious, but whose better judgment dictates "wet heat," may now find their happy answer in Nesbitt Baseboard.—*Get Publication 272.*

—and to save you money

MADE BY JOHN J. NESBITT INC., PHILA. 36, PA.—SOLD EXCLUSIVELY THROUGH PLUMBING AND HEATING WHOLESALERS



1 Fasten enclosure-back to wall with screws or nails.

2 Mount the support brackets at indicated intervals.

3 Hang the assembled heating element on brackets.

4 Insert louvre blade between slots in support brackets.

5 Hang front panel on brackets, push to lock in place.

6 Attach joint trim over intersections for finishing touch.

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

ASKS WHEN DOES GUARANTEE PERIOD END?

I WOULD BE MOST interested in any published information or comment by HPAC readers pertaining to a problem we have been involved in in connection with the heating of our buildings.

In 1950, a piping contractor finished a large steam and hot water distribution system in tunnels. Most of the condensate returns are 4 in.

Before the contractor finished the entire job, condensate was connected to the 4 in. condensate line and shortly thereafter occasional leaks developed in the joints, which the contractor repaired. After the contractor finished his work, but before the consulting engineers or owners accepted the work, many more leaks developed and the contractor kept on repairing them.

In the summer of 1951, the leaks in the same joints re-occurred so frequently that an investigation was made and it was determined that the contractor had not followed the specifications in making the joints.

The contractor was then requested to open all joints which had leaked at one time or the other and close them in strict accordance with the original specifications, after a thorough cleaning of all surfaces.

Although he agreed to do so, he soon went back to the consulting engineers and asked permission to make all the joints by a different method because of the high cost of labor if all joints were taken apart, cleaned and closed in accordance with the specifications.

The consulting engineers agreed to this and the work was done during the summer of 1951. Shortly thereafter, some of the same joints leaked again and the contractor repaired them.

For a few weeks after this, no leaks developed and the consulting engineers accepted the work in September 1951 subject to the one year guarantee in the contract.

Through the following 12 months, new leaks developed and old leaks re-occurred, which the contractor repaired.

In September 1952 we had seven such leaks. The contractor repaired these in October and advised us that he had filled his contract obligations.

Since then, we have had many re-occurring leaks of joints repaired by the contractor in the last two years, which he has refused to repair.

The contract states: "No certificate for payment issued by the Architect or Engineer and no payment, final or otherwise, nor partial or entire use or occupancy of the work by the Owner, shall be an acceptance of any work or materials not in accordance with the contract, nor shall the same relieve the Contractor of responsibility for faulty materials or workmanship or operate to release the Contractor or his surety from any obligation under the contract or the Performance Bond."

We feel that the one year guarantee begins after a particular joint has been repaired for the last time.

If other readers of HPAC have been confronted with similar situations, I'd certainly like to know of them and how they resolved the question.

[Editor's note — The name of the reader who asks about this matter is withheld from publication at his request.]

SUGGESTS DRAIN AT BOTTOM OF COMPRESSED AIR RECEIVER

THE DATA SHEET ARTICLE, Compressed Air Plant's Success Depends on Distribution Piping, in the March HPAC, is most timely. There can be no question but that if all air distribution piping systems were laid out and installed on the basis of the recommendations contained in the article in question, there would be far less trouble experienced in supplying compressed air to pneumatic equipment.

It has been my observation that failure of air distribution systems to deliver air to the point of usage at the required pressure and quantity is almost invariably due to improper layout and improper sizing of the air mains and laterals. Pressure drop in air piping systems has caused endless trouble and expense over a long period of time, but fortunately the past few years have witnessed much improvement in compressed air installations.

Credit for much of this improvement is due in a very great measure to such organizations as the Compressed Air and Gas Institute and other organizations in this field who have been doing an outstanding job of selling good compressed air practices to industry for a long time.

I can offer only one suggestion for inclusion in the article under discussion — namely, that a drain be placed on the bottom of the air receiver, with one outlet for blowing water and oil out manually and the other connected to a trap to remove water automatically, as it accumulates. Traps are available for this service.—C. T. BAKER, Consulting Engineer.

URGES COMPILATION OF NATIONAL CLIMATIC ATLAS

I SHOULD LIKE TO offer the following comments on the article, Measuring the Weather, by A. Donald Hay, published in the March HPAC.

Mr. Hay's presentation of the elements of climatic measurement directed toward their effect upon the design of systems for control of indoor environment is most timely. There has been an unfortunate lack of interest in this most important basic element of design.

The economic value of an accurate knowledge of prevailing climatic conditions is emphasized today by the increasing demand for air conditioning and the relatively high cost of mechanical equipment, energy and fuel. Mr. Hay stresses this in the statement "where each increase of 1 F in wet bulb temperature cost an additional $1 million for air conditioning." This fact alone directs that the designer maintain weather air quantities at a minimum where

high wet bulb temperatures prevail. It is, however, a common failing of many air conditioning systems designed under present criteria to provide insufficient dehumidification. Where industrial operations are involved, too high a humidity can be disastrous to the product.

The use of "mean" temperature conditions has long been responsible for resultant design inaccuracies. The "average" condition offers only slightly greater accuracy. A "true" condition can only be selected by taking the *time* of climatic incidence into account, together with the duration of coincidental extremes, such as high wind and low temperature and high wet and dry bulb temperatures.

The data accumulated by the U. S. Weather Bureau *hourly* over the last 15 years provides a wealth of material which, when properly processed into useful tables, charts and maps, would serve both the architect and the engineer as a sound basis for the exercise of technical judgment. The compilation and publication of a national climatic atlas is a current objective of equal public value with a geographical atlas. Planning of such an atlas is underway by the U. S. Weather Bureau, but it is prerequisite that each professional or industrial interest indicate its desires and the type and form for presentation of climatic data most useful to its requirements. Agriculture, transportation, construction, and mechanical and electrical engineering each have a requirement for the same data but with a varying point of emphasis. While graphic presentations might be adequate for one type of problem, actual tabulations of the incidence of climatic variables might be a necessity for another.

The United States, unfortunately, lags behind other countries in having a climatic atlas for ready reference. The USSR has had one for some time. Canada has recently completed an initial step by preparing a climatic atlas which will be subject to future growth and refinement from year to year.

The weather is everybody's business and at the same time is no "one's" business. No single interest has, so far, undertaken commercial sponsorship of a climatic atlas. Since such is literally everyone's business, it seems proper that it be prepared at public expense by the U.S. Weather Bureau with the guidance of those varied interests it would serve. —THOMAS H. URDAHL, Consulting Engineer, and Chairman, Climatic Research Committee, Building Research Advisory Board, National Research Council.

AIR CONDITIONING FOR MEAT PACKING PLANTS

THE ARTICLE BY Samuel R. Lewis in the January HPAC, Conditioning Air for Process and Comfort in Meat Packing Plants, is very interesting and is another example of the application of a little thought to the particular problem at hand.

The use of ribbed glass plates for eliminators is a unique solution of the problem of rapid corrosion of eliminators. It gives rise to the thought that the use of glass and wood in an air conditioning system might complicate the labor situation by perhaps adding two more trades to those ordinarily employed.

The description of the duct arrangement in the sausage dry room is of interest. An arrangement employing multiple points of introduction of air from ceiling ducts was used in an air conditioning system designed in this office for a curing room in a food processing plant over 20 years ago. The curing process was principally moisture reduction in the product. In this instance satisfactory results were obtained without the use of ducts at the floor or reversals of air movement.

Some 15 years after the above installation was made, an additional curing room was built and the air conditioning design and installation was made by a contractor. It consisted of a more complicated and expensive arrangement, and failed to produce satisfactory results. This office was then commissioned to correct the conditions and the original system layout was followed with satisfaction to all concerned. —A. C. KING, Consulting Engineer.

NEW SEALTEST ICE CREAM PLANT IN PITTSBURGH

PART OF THE PRODUCTION room of the new plant, as installation of new equipment neared completion. Projecting from the tile wall at right are the six 3,000 gal cold wall storage tanks for pasteurized ice cream mix. Two 200 gal flavoring vats are located on the floor at the extreme right. In the right foreground are the stainless steel floor escutcheons shielding pipe lines ready for connection to four 150 gal freezers. Three 400 gal and five 200 gal freezers already installed can be seen farther down the row (extreme left). Projecting from the floor at lower right is one of the three-way pedestal wash-up stations installed throughout the plant. The three faucets in the pedestal provide hot water, cold water, and pre-mixed detergent cleaning solution, respectively

"We prefer

REVERE COPPER WATER TUBE TO ALL OTHER MATERIALS

for Radiant Panel Heating because of its easy workability, permanence and the assurance of a quality job"

says A. C. HARDEN
President
Harden Heating & Air Conditioning Co., Elmwood Park, Ill.

. . . AND MR. HARDEN HAS OVER 550 COMPLETELY SATISFACTORY INSTALLATIONS IN HOMES AND CHURCHES TO BACK UP HIS STATEMENT!

"Because we have a reputation for quality work to uphold, we can't afford to take chances and use inferior materials. In addition, Copper Water Tube is so easy to bend, so easy to work with in the tightest spaces and requires no thread cutting so that it saves us a lot of installation time. We have also found that we can place the utmost faith in the fittings when using Copper Water Tube."

"Those are the reasons we prefer copper to all other material". And Mr. Harden speaks from experience. For he has installed copper radiant panel heating systems in over 50 churches and more than 500 residences, and all are completely satisfactory in every respect. The oldest has been in operation for 7 years.

Take a tip from Mr. Harden's experience . . . keep out of trouble with copper.

Now with restrictions eased, and quantities permissible without allotments greatly increased, there isn't any reason why you can't use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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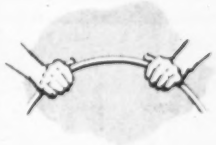
SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

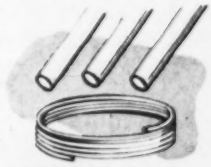
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions. Hard temper by hand bending tools.

HANDY LENGTHS

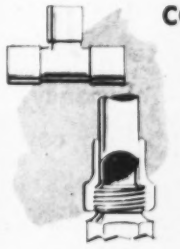
Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.



SOLDER OR COMPRESSION FITTINGS

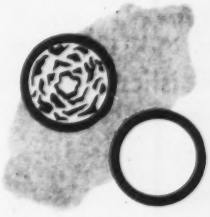
Need Less Work Room . . . Save Metal

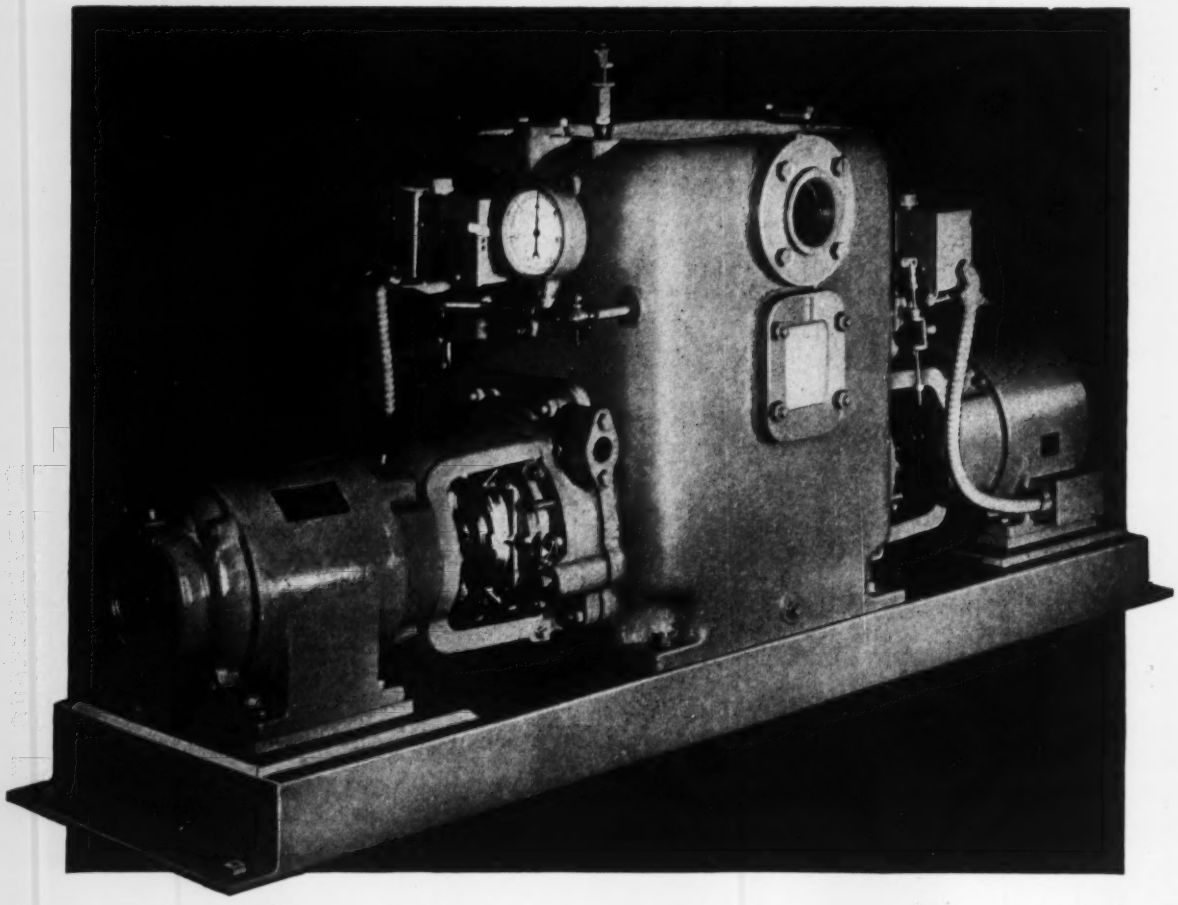


No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.





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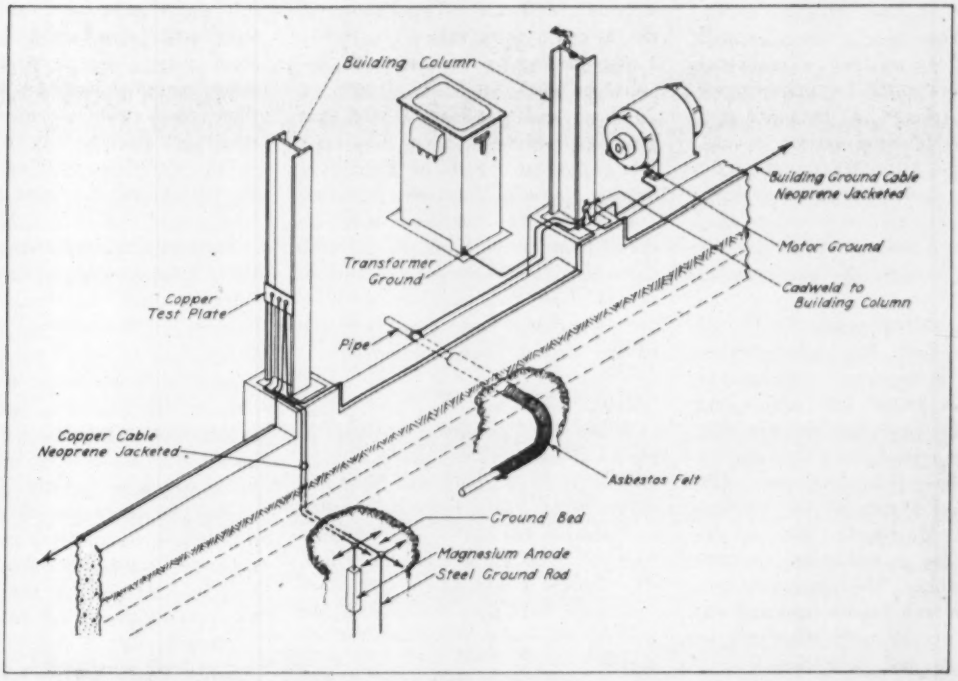
For the actual working capacity of your Jennings Pump is determined by careful tests under working conditions, and with the actual motor that goes on your job, regardless of current characteristics. Every Jennings Pump has to deliver full rated capacity of air and water simultaneously before it is released.

The Jennings Heating Pump has everything in the way of safety, convenience, and real dollar saving economy that years of experience as leading heating pump manufacturers have enabled us to put into it. Quality is backed by an unchallenged reputation, and satisfactory performance is assured by a nation-wide network of Sales and Service offices.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.



TYPICAL GROUNDING ARRANGEMENTS used at the Fairless Works to protect against corrosion

Fighting Underground Corrosion at the New Fairless Works

How Piping and Other Services Are Protected

By William E. Coleman and Harold G. Frostick
United States Steel Corp.

SUMMARY — The four features of the new underground system at the Fairless Works complement one another in combating underground corrosion. (1) Elimination of bare copper underground reduces galvanic corrosion. (2) Magnesium anodes protect the steel ground rods and serve to partly protect all underground piping, lead cables and foundations. (3) Insulating coverings on pipes and cables protect their metallic surfaces and reduce the requirement for cathodic protection. (4) The design of the ground bed installations permits analysis of the stray-current corrosion problem.

PUBLIC UTILITY companies have been actively fighting underground corrosion for many years. Through organized programs, they have succeeded in limiting corrosion damage to the minimum that can be tolerated without excessive maintenance costs. Other industries have more recently taken an active interest in this subject, and are finding that an investment in fighting underground corrosion pays good dividends.

Mr. Coleman is with U. S. Steel's research and development laboratory, and Mr. Frostick is with the corporation's construction engineering bureau.

In most industrial plants — and particularly in steel mills — above-ground corrosion is common enough to be well recognized. Combating this enemy is costly, but maintenance is seldom relaxed to the point that serious visible deterioration occurs. It is damage by underground corrosion that is not always properly evaluated until too late. Eventually, a plant shutdown will emphasize the insidious inroads of underground corrosion.

In the past few years, the United States Steel Corp. has undertaken an extensive preventive program to fight underground corrosion. As part of the program, designs that tend to minimize factors encouraging corrosion have been developed. The underground system of the Fairless Works, at Morrisville, Pa., is designed to be as corrosion resistant as practicable. The principles embodied are well known engineering-wise and can be used effectively in other plants and industries.

Types of Underground Corrosion

The metals giving most concern in underground corrosion problems are steel and lead. They occur in the earth as compounds and must be purified before they can be used. Both are susceptible to corrosion and, unless protected, will eventually return to their former states in combination with nonmetallic elements. When steel or lead is so situated that an electric current can flow from either into an electrolyte, corrosion will occur where the current leaves the metal; that is, the metal will go into solution. An electrolyte (such as water) is essential. If the metal can be kept perfectly dry, appreciable corrosion will not occur at atmospheric temperatures.

An electric current is also essential. If the current can be eliminated, corrosion will likewise be eliminated.

All corrosion is electrochemical. Early in the 19th century, Michael Faraday demonstrated the principle governing corrosion. This principle, which is now known as Faraday's Law, may be stated as follows: (1) The amount of chemical change produced by an electric current is proportional to the quantity of electricity flowing, and (2) the amounts of different substances liberated by a given quantity of electricity are proportional to their chemical equivalent weights. Mathematical application of this law will show that a current of 1 amp passing for one year will dissolve as much as 20 lb of steel or 75 lb of lead. It can be seen that even small currents, when they exist for any great length of time, will destroy appreciable amounts of metal.

Underground corrosion may be divided into three types — galvanic corrosion, stray-current corrosion, and local-cell corrosion. The names are somewhat indicative of the source of the electric current involved.

Galvanic Corrosion

When two dissimilar metals in electrical contact are placed in an electrolyte, a current will pass between them. This current is called a "galvanic current" — after Luigi Galvani, who discovered the effect. The voltage developed by a so-called "galvanic cell" is a function of the natural difference of potential of the metals.

A good example of galvanic corrosion is the corrosion that results on burying copper and steel in earth. A natural battery or galvanic cell is formed with the earth as the electrolyte. The current passes through the earth from the steel to the copper, and the steel corrodes. Copper and lead also form galvanic cells that can develop corrosion currents of appreciable magnitude. Lead and steel are much closer together in potential than either copper and steel or copper and lead, so that the galvanic current between lead and steel is usually much lower and, hence, is less destructive.

Galvanic currents in underground installations are generally small, but are continuous and can do considerable damage — particularly if they are confined to small areas of a structure or if they flow for long periods of time.

Stray-Current Corrosion

Stray-current corrosion is often called electrolysis and results from a direct current passing through the earth from one metallic structure to another. Corrosion will occur where the current leaves the structure and enters the earth.

In steel plants, where huge blocks of direct current power are utilized, the amount of stray direct current existing accidently in the soil can be very large. Stray currents may result from occasional grounds on equipment, from faulty insulators or from many other sources. Since these currents may be large, and since they can re-enter metallic structures to leave again at other points, the damage done by stray-current corrosion is both severe and widespread.

Stray alternating current does relatively little damage, so that the term "stray current" usually applies only to stray direct current.

Local-Cell Corrosion

Local-cell corrosion is complex. It develops from local differences of potential in an environment, and its intensity varies greatly in different soils. As a result of these local differences in potential, local electrical currents will flow. Such currents will in time corrode the metal just as severely as would an externally applied current.

Local-cell corrosion is a phenomenon difficult to predict but relatively easy to correct.

Combating Underground Corrosion

All underground metal used in a steel plant is subject to the destructive effects of all three types of corrosion. The underground system of a large steel plant includes many tons of steel pipe and foundations, and many miles of lead-covered power and communication cables. Damage from galvanic corrosion and from local-cell corrosion can be minimized very effectively by the proper type of installation. Stray-current corrosion is somewhat more difficult to control, but a number of precautions are possible.

Elimination of Bare Copper in the Earth

For safety — and for other reasons — every electrical system must in some manner be connected to the earth; copper has generally been used for this purpose because it resists corrosion extremely well. It is well known, however, that copper accelerates the corrosion of other buried metals with which it is in electrical contact. Using copper for ground rods can thus damage steel foundations, pipe lines and lead-covered cables.

At the Fairless Works, steel rather

than copper is used for electrical grounding. The electrical circuits between the steel rods and between the rods and the steel structures are made with copper cables, but the cables are neoprene-covered to prevent their contact with the earth. The connections to the rods are taped with neoprene, and the connections to the building framework are made above the ground level. Individual building columns are also connected with neoprene-jacketed copper and the connections made aboveground

Hence, for all practical purposes, there is no bare copper in the earth, so that the development of galvanic cells between copper and other necessarily exposed metals is avoided.

Protection of Steel Ground Rods

Because steel ground rods can rust, something must be done to protect them from rapid deterioration. As an item of cost, the loss of steel is not significant; but because the steel is an integral part of the electrical system, an investment in protection is warranted. The damage to steel ground rods may occur from a combination of local-cell and galvanic corrosions.

To minimize this, the new system at the Fairless Works utilizes buried magnesium electrodes, which are anodic to steel. These magnesium anodes are buried near the steel ground rods and are electrically connected to them above the ground. Since magnesium is anodic to steel, the developed galvanic current passes through the soil from the magnesium to the steel. This current can be of sufficient magnitude to overcome the local-cell and galvanic currents on the surface of the steel. The steel is thus made to receive current rather than to discharge current and is thereby protected from corrosion. (This method of minimizing corrosion is known as cathodic protection, because the steel is made the cathode.)

The magnesium will corrode in protecting the steel because current is leaving the magnesium to go into the earth. If copper were present, the magnesium would deteriorate quite rapidly because a considerable quantity of current would flow to the copper. Elimination of the copper in the earth makes it economically possible for the magnesium to protect the steel; and because magnesium is also anodic to lead, the lead-covered cables are likewise protected cathodically.

Other methods of providing this protective current are also in common use. For example, an external generator or rectifier may be used to force current into the ground and out through the steel rods. The type of installation used depends upon many design factors.

Insulated Coverings on Cables and Pipes

If the surface of buried metal can be kept dry, corrosion will be prevented. This cannot always be done, but is highly desirable in many cases.

At the Fairless Works, a protective covering has been used on all steel pipe used for water, gas and oil. On pipe, a coating of coal-tar enamel and then a wrapping of coal-tar-saturated asbestos felt have been applied. On lead-sheathed power and communication cables, a neoprene jacket has been used as a barrier between the metal and the moist earth.

Under these conditions, current can leave the covered metal only at designated drainage points or at incidental holes and breaks in the protective covering. Even these small breaks, which may occur during handling and installation, will receive some measure of protection from the magnesium anodes.

Special Electrical Ground Beds

One of the most important features of the underground system at the Fairless Works is the use of clearly marked, maintainable ground beds consisting of steel rods and magnesium anodes. These beds have been carefully placed for the protection of electrical equipment and personnel. They have been designed as independent units that can be used as test points for earth-current studies. The steel rods and magnesium anodes are wired in separate circuits. This permits measurements of stray currents and of cathodic protection currents.

The earth resistivity in the Fairless Works area is quite high. This condition necessitated the use of long ground rods in relatively large numbers, so as to obtain a ground resistance low enough for proper protection. The steel rods used are 40 ft long and $1\frac{1}{4}$ in. in diameter. A slight modification of the usual anode made it possible to use the magnesium anodes as electrical ground rods as well as cathodic-protection electrodes. Each magnesium anode is made of a 1 in. diameter steel rod, 20 ft long, with a piece of magnesium 10 ft long and 4 in. square cast onto the center section of the rod. This unit is buried in the earth in a prepared backfill designed to lower the contact resistance between the anode and the earth. The anodes are located in the ground beds in such a manner that protective currents can flow both to the steel ground rods and to nearby buildings, piping, foundations and cables.

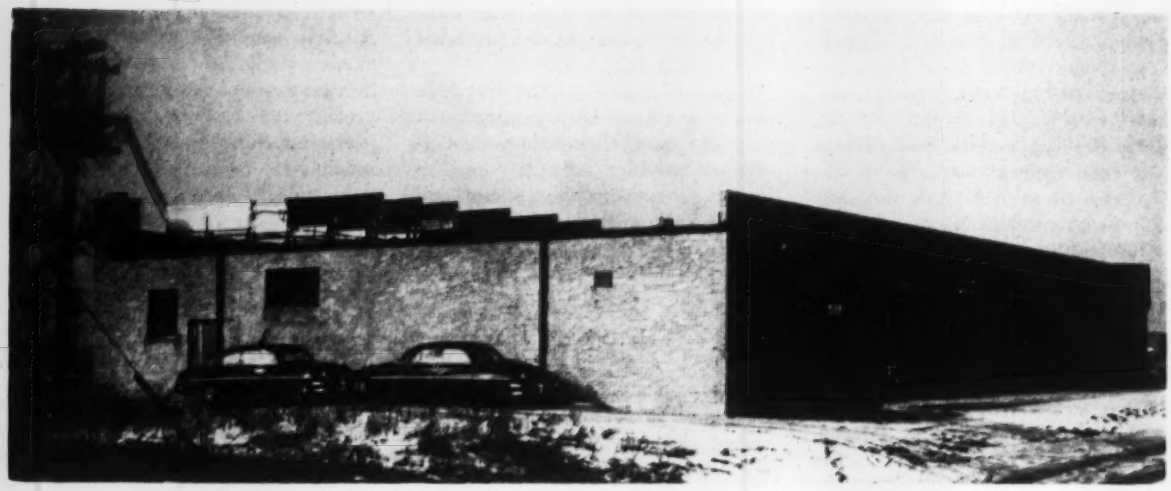
A program of check measurements for testing the overall operation of the system has been organized. This program calls for periodic inspection of the ground beds; measurements of ground resistance of both steel rods and magnesium anodes; measurements of cathodic currents between the anodes and the rods, and between the anodes and the buildings; and determination of any other current to or from the ground beds. These measurements will also permit predicting when the magnesium must be replaced.

MUST ENCOURAGE TREND TO MACHINE POWER

MANPOWER — AMERICA'S most valuable asset — is in danger of becoming one of the nation's most critical defense shortages.

"We are close to the bottom of the manpower barrel," says George Fielding Eliot, in the April issue of the American Iron and Steel Institute's magazine, Steelways. "We have no choice but to encourage the trend toward quality rather than quantity of workers, machine power rather than manpower."

The author contends that a long-term solution to the problem depends upon a continuation of the 50 year trend of technological advances in industry and greater dependence upon skilled labor. The average worker produces about six times as much goods per man-hour now as he did in 1850. The national income has increased about 30-fold measured in dollars of comparable purchasing power.



10 FIN COIL HEAT EXCHANGERS on the roof supply heat for the building from the outdoor air in winter, dissipate it in summer

Air-To-Air Heat Pump

. . . . installation provides winter heating and summer cooling — with satisfaction and economy — to small Illinois factory

THE HEAT PUMP has aroused a considerable amount of interest in the last few years because of the many desirable features it possesses. The use of electrically operated equipment to provide heating in addition to cooling enhances its attractiveness. However, it is the "getting something for nothing" — as otherwise waste heat is used from the ground, water or air — that makes this type of heating system especially attractive.

One such installation recently made in the Chicago area has proved highly satisfactory during its operation — both in the heating results achieved and the costs of installation and operation. The Walter Precision Co., in Franklin Park, is a manufacturer of very small instrument parts. About a year ago the company built a new plant, consisting of a one story office and factory building, of some 8500 sq ft, to house its 20-man operation. Because of the nature of the work, year 'round air conditioning is a "must".

Internal Heat, Water Supply Affect Choice

In designing the air conditioning system, several inherent factors had to be taken into consideration. First, a large internal heat load from high intensity lighting, motor operated machines and some 20 people would be a liability when cooling was required but an asset for heating. Second, approximately 35 to 45 gpm of water would be required for conventional 30 ton water cooled refrigerating equipment. Third, the suburban community of Franklin Park has no public water system, and it would be necessary to obtain all water — at considerable cost — from wells.

Confronted with this situation, the air conditioning consultant, Joseph Lazar, of Refrigeration Systems, Inc., suggested the use of a heat pump to August Schlotfeldt, owner of Walter Precision.

An air-to-air heat pump system was designed. It consists of two standard 20 hp refrigerating units. The compressors are so controlled automatically that, when operating on either the cooling or the heating cycle, the capacity of one or both may be used.

The indoor portion of the system for conditioning the factory space and offices is a conventional arrangement of air handling equipment, heat exchangers and duct work. The one difference is that the coils can be used as a condenser or an evaporator, depending on whether the system is operating on the heating or cooling cycle.

10 Heat Exchangers Are on Roof

Probably the only departure from a standard air conditioning equipment layout are the heat exchangers on the roof. These 10 fin coils, each approximately 3 ft high and 11 ft long, serve as either a condenser or evaporator. Situated as they are in the open, normal wind velocities provide air movement across the coils at speeds considered good practice in air conditioning design. The valves, controls and piping which complete the system are also of the conventional type. All valves for changing over the system from heat-

ing to cooling, or vice versa, are manually operated.

The plant engineer operates each compressor-coil arrangement on alternate days. In addition to equalizing the wear on the compressors, this method provides for coil defrosting when the equipment is used on the heating cycle. Sufficient heat is absorbed from the atmosphere on the offday to permit the coils to defrost themselves. No defrosting problems have occurred to date. However, if difficulties should arise the hot gas defrosting method can be used.

Because of the lack of engineering data on installations of this kind, four coils are used with one of the compressors, and six coils with the other. No appreciable difference in heat in operation of either unit has been noted, so it has been concluded that the four coils are sufficient.

"Highly Satisfactory" Heating and Cooling

The system has been operating for approximately a year, and the following operating experience is reported.

1) "Highly satisfactory" heating and cooling of the building has been provided by the heat pump installation.

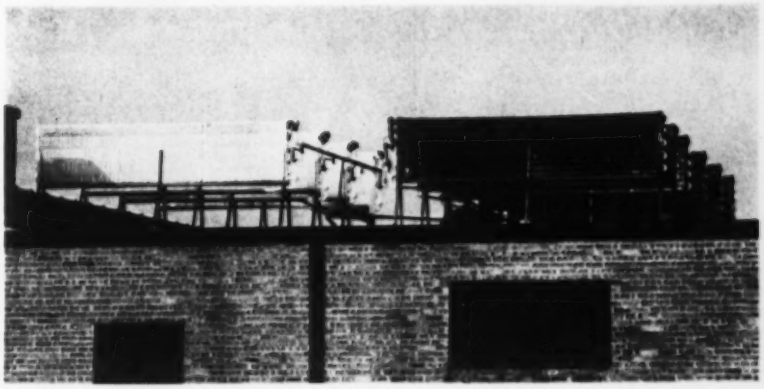
2) After the initial adjustments were made to the system, no unusual maintenance has been necessary.

3) Only one compressor has been used a majority of the time for either heating or cooling, which indicates sufficient capacity has been engineered into the system. (This "excess capacity" seems to be the operating experience with most heat pump installations).

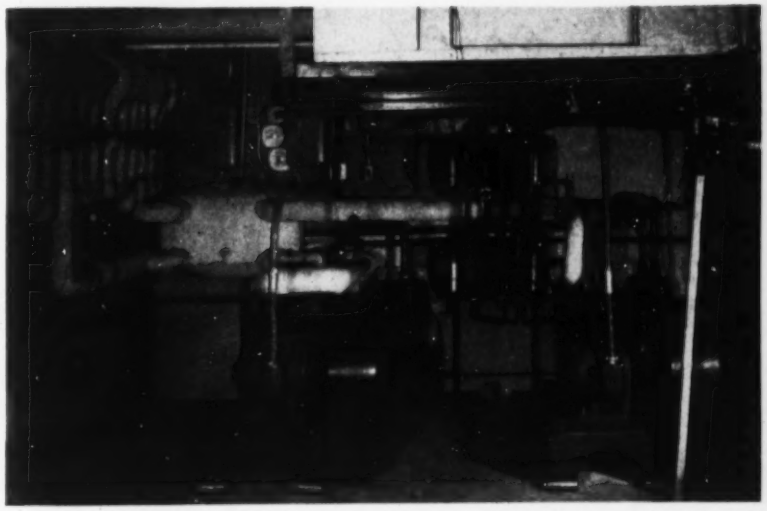
4) First cost of the heat pump system was less than for conventional equipment providing both heating and cooling. (Some $3500 less in this case, according to Mr. Lazar. Total cost of the heating and cooling installation, including everything — refrigeration, duct work, piping, controls, wiring, etc. — was around $25,000.)

5) Operating cost for the electric powered heat pump system is competitive with costs for other types of year 'round air conditioning equipment.

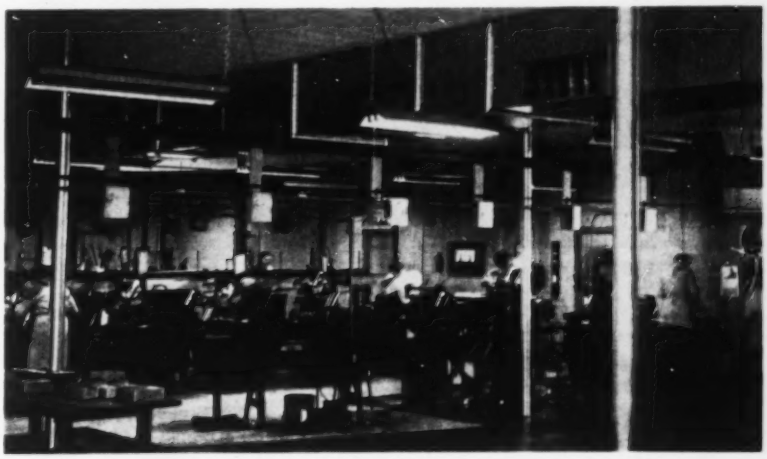
Refrigeration Systems, Inc., Chicago, designed and installed this heat pump system.



THE COILS "DEFROST THEMSELVES" (usually) when not in operation. Six coils are used with one compressor, four with the other. Operating results have shown four to be sufficient

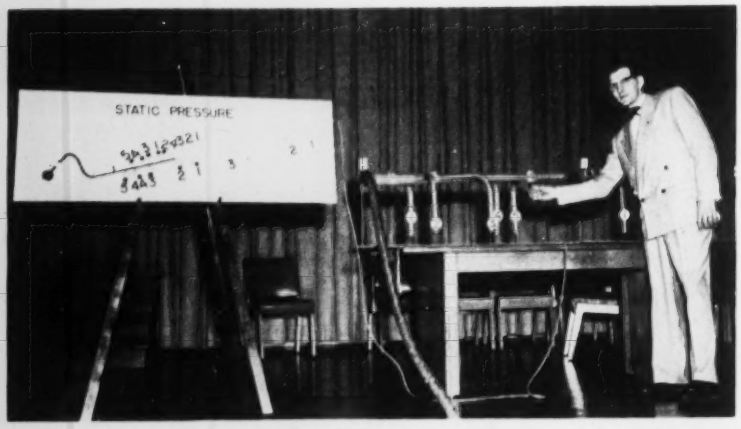


THE AIR-TO-AIR HEAT PUMP system includes two 20 hp refrigeration machines. Control is automatic so that one or both of them may be used on either the cooling or heating cycle



LARGE INTERNAL HEAT GAIN from lighting, motor operated machines and the occupancy — as well as lack of a water supply — influenced the choice of the heat pump system. Year 'round air conditioning is a "must" because of the precision work done

"TALKS, NOT PAPERS" . . . .



MANY DEMONSTRATIONS, and . . . .

CLASS-ROOM SESSIONS featured at . . . .

Industrial Ventilation

. . . . Conference held at Michigan State, were "enthusiastically received". Norman R. Olson summarizes them in this special article for HPAC

THE THEME OF THE second annual industrial ventilation conference held at Michigan State College, East Lansing, can perhaps be summarized as follows:

"Adequate industrial ventilation requires (1) that management be sold on the necessity and proper installation of ventilation facilities; (2) proper engineering of the systems; and (3) proper maintenance of existing systems, with complete records."

The conference — held during the week of February 16 — was developed cooperatively by the Division of Industrial Health, Michigan Department of Health and the School of Engineering, Michigan State College. It was enthusiastically received by the 142 people who registered. The group included plant engineers, contractors, consulting engineers, industrial hygienists, and educators — to mention a few of the fields represented.

"Talks, Not Papers" Are Featured

The schedule was intensive and complete from the Monday morning registration until the noon luncheon on Thursday, when L. G. Miller, Dean of Engineering, Michigan State College, presented certificates to the conferees.

"Talks, not papers" (as emphasized by K. E. Robinson, Ventilation Consultant, General Motors Corp.) and demonstrations were presented each morning and afternoon in the auditorium, each followed by class-room sessions. For these sessions the registrants were divided into two groups, beginners and advanced. The beginners spent considerable time in the detailed calculation of typical factory dust collecting systems, with emphasis on the fundamentals of hood and duct design. The advanced class worked out a detailed solution of some dust collecting systems, vapor exhaust systems, and exhaust systems for a paint baking oven, paint spray booth, and an isolated welding operation.

It should be emphasized that, although these operations represent only a few of the many problems found in industry, they are sufficient to teach the proper procedure required in designing any industrial ventilation system. These problems also enabled the students to become acquainted with the Industrial Ven-

tilation Manual, a compilation of recommended practice, which was used throughout the conference. This manual is an invaluable aid in the solution of industrial ventilation problems and may be secured from the Committee on Industrial Ventilation, P. O. Box 453, Lansing, Mich.

Pitot Tube Demonstration Opens First Session

Dean Miller welcomed the group to the conference and introduced the first speaker, W. H. Williamson, Project Engineer, American Wheelabrator and Equipment Corp., who opened the first session with a pitot tube demonstration.

It was revealed at the first conference last year that a great deal of confusion existed concerning the calculation and understanding of fan static pressure. This demonstration was performed at the beginning of this year's conference so that everyone became familiar with the nomenclature to be used throughout the sessions and had an understanding of how total pressures, static pressures and velocity pressures can be determined with a pitot tube.

Actual pitot tube readings were taken in a 7½ in. round duct which was connected to a centrifugal fan. It was pointed out that an approximate average reading could be obtained if the reading at the center of the duct was multiplied by 0.81. The more accurate method, however, is to use the 10 point traverse system, where readings are taken at 10 points in the vertical plane and 10 points in the horizontal plane to obtain an average.

Mr. Robinson delivered the second address of the opening session, his talk being on the results of a model study of general ventilation.

The two movies shown during this talk were highlights of the conference. The first was a demonstration, using titanium tetrachloride smoke, of air flow through various types of hoods which were modified in many ways to illustrate the effect on air flow into and through the hoods. The tests were on model hoods; however, actual conditions were simulated and a vivid demonstration was given of the effectiveness of various hood modifications, such as flanging of the inlet, location of the hood with respect to the smoke source, and use of slot type entrances.

The second movie was a demonstration of air flow in a transparent plastic model of a factory building. Smoke was induced at various locations and air flow was observed when fans in the roof and walls were turned on and off. Various windows were opened and closed to illustrate the resulting air flow. The demonstration emphasized such points as the necessity for make-up air and avoidance of short circuiting.

Air Velocities and Hood Design

Jack Baliff, Senior Industrial Hygiene Engineer, New York Department of Labor, spoke Monday afternoon on velocities — control, slot, and carrying.

The importance of the basic formulas of air flow was emphasized:

1) $Q = AV$ = the basic formula for cfm of air delivered.

2) $V = (2gh)^{\frac{1}{2}}$ or $V = 4000\ (VP)^{\frac{1}{2}}$, where V is in feet per second and VP (velocity pressure) is in inches of water.

3) $h_f = f\ (L/D)(V^2/2g)$ = friction loss in closed pipe, where f = friction factor, L = length of pipe, and D = diameter of pipe.

The principal consideration, of course, is the fact that the pipe friction varies as the square of the velocity.

The control velocity of air entering a hood is that necessary to stop the particles and turn them around. To do this effectively requires sufficient capture velocity (velocity at the source of the contaminant) and adequate hood design. Particular stress was placed on designing hoods with as great a depth as practically possible, as a mass of air working through a greater distance is capable of stopping and turning more particles.

The most important considerations in maintaining good control and operational economy are:

1) Hood should enclose the contaminant as much as possible.

2) Hood depth should be as great as possible, practically speaking.

3) Face area of hood should be kept to a minimum.

4) A reasonable velocity through face of hood should be used, depending on the contaminant.

For free hanging hoods, if hood opening dimensions are indicated as W = width and L = length:

If W/L is greater than 0.1, the following formula will apply for calculating the cfm of air necessary:

$Q = V[(X^2 + bA)/b]$, where b = factor depending on the W/L ratio.

X = distance from hood opening, ft; V = centerline velocity at distance X; A = cross sectional area of the opening.

W/L	b	W/L	b
0.1	0.02	0.6	0.071
0.2	0.037	0.7	0.075
0.3	0.040	0.8	0.078
0.4	0.050	0.9	0.081
0.5	0.065	1.0	0.085

When W/L is less than 0.1, the opening is considered a slot and the following formula applies: $Q = 3.7\ XVL$.

In the past it has often been thought necessary to maintain high slot velocities. Tests have shown, however, that excellent control can be obtained with slot velocities in the neighborhood of 2000 fpm with reasonably good distribution over a slot length of 6 or 7 ft.

When calculating the resistance through this type of hood it is first necessary to calculate the loss through the slot, which equals 1.78 $\times$ VP, where VP = pressure corresponding to the slot velocity. To this must be added the loss through the rest of the hood to the branch duct, which depends on the hood configuration.

The transport velocity required in the ducts is dependent on size, density, shape, the natural tendency of particles to join, to pick up moisture, etc. These factors must all be considered when determining the velocity necessary to keep the particles in suspension.

Monday evening was devoted to a general discussion of particular problems submitted by the registrants.

Congested industrial areas make the disposal of collected materials difficult. One approach to this problem was indicated in a movie. This movie, Power from Waste, showed an installation where suspension burning of kiln dried sawdust from a collecting system was used to produce steam for the plant. The sawdust was blown into the firebox through simple nozzles at velocities of 4500 to 6000 fpm. Tests indicated that 5 lb of steam were produced per pound of sawdust burned.

Good Design Means Operating Economy

Howard Limbacher, of Ingersoll Products Div., President, Western Michigan chapter of the American Society of Heating and Ventilating Engineers, was chairman of the Tuesday sessions. He introduced Roger Browne, Jr., Supervisor, Plant Layout, Cadillac Motor Car Div., who

spoke on the effect of duct fittings on operation.

Models of a properly designed duct system and a poorly designed duct system (main duct and branches built to scale) were used in this demonstration to illustrate the effect of poor design. Pitot tube readings were taken at a number of points and in this particular test it was found that when exhausting approximately 100 cfm, the poor design required 0.136 brake hp as compared with 0.05 hp for the well designed system. Properly designed ducts, therefore, can result in real operating economies.

Unwanted Heat Is an Air Contaminant

Willis G. Hazard, Owens-Illinois Glass Co., presented an interesting lecture and demonstration Tuesday afternoon on the subject of radiation heat and comfort.

Mr. Hazard impressed upon the group that heat is often an air contaminant and should be treated as such. However, the summer heat load on a worker near a furnace in certain "hot" industries can be three-fourths radiant heat and one-fourth hot air, he said. Therefore, when using general ventilation only, we are attacking only one-fourth of the problem.

The speaker had a silhouette of a man's head that was aluminum foil on one side and painted black on the other. A thermopile in the head was connected to a thermometer. He first blew at the black side of the head with a miniature (1300 watt) unit heater which increased the head temperature. A miniature fan directed across the heated-air stream deflected it from the head and so cooled the latter down. He then directed a 250 watt infra-red light at the black side which again increased the temperature, but it was not altered when the fan was turned on. It must be remembered, however, that a blast of air can of course produce a cooling effect by evaporating perspiration. Mr. Hazard's point was well taken and illustrated the difference between radiant heat and heat carried by convection.

The temperature increased very little when the heat sources were directed at the aluminum surface, as it reflects about 90 percent of the radiant heat.

Much progress has been made the past few years in the use of reflective shields to protect the worker from radiant heat. The effectiveness of various materials for this purpose was demonstrated. Aluminum sheet, cloth covered aluminum, and tinted plate glass were the most effective of the materials tested. Reflective clothing (cloth covered with vaporized aluminum coating) has proved very successful in many applications in the form of aprons, jackets, coats, trousers, etc.

Fan Problems and Make-Up Air

The Wednesday sessions were presided over by Albert E. Heustis, M. D., Commissioner of the Michigan Department of Health.

Vic John, Manager, Industrial Div., Detroit office, American Blower Corp., presented a commentary on fan problems. The different types of fans and blowers were described with their particular applications. The most frequent causes of a fan delivering less air than expected were mentioned in the order of their importance:

1) Poor duct layout.

2) Faulty connections to the fan.

3) Failure to consider other fans in the space.

4) Inaccurate calculation of static pressure requirements of the fan.

Advantages of Tempered Make-Up Air

Wednesday afternoon, Robert Waalkes and Charles Pesterfield — both with Michigan State's School of Engineering — discussed make-up air and selection of equipment.

If the air exhausted from a space exceeds three air changes per hour, it is necessary to provide a tempered mechanical supply system, they said. The following difficulties arise if no outside air is mechanically admitted to the space:

1) The building is subjected to a negative pressure with the system operating under a higher static pressure and less cfm than expected. Contaminant control is then lost because of insufficient velocities through the hoods.

2) Reversal of flow into the building through flues may occur.

3) Control may be lost due to high velocity air leaking in building in areas near hoods.

4) Uncomfortable working conditions may occur near windows and doors.

5) Contamination of otherwise clean areas carried by draft if hoods get out of control.

Advantages of make-up air are:

1) Reduce complaints.

2) Reduce infiltration.

3) Increase in heat load is not as great as sometimes thought, because without mechanical supply infiltration air has to be heated.

4) Can arrange design so supply air is used for general ventilation of whole space.

5) It was possible to reduce exhaust fan requirements as much as 35 percent, in one case mentioned, due to addition of mechanical supply.

When designing a mechanical supply air system it is necessary to:

1) Locate exhaust hoods and calculate cfm requirements of each. Location should be such that supply air will not disturb air near hoods, which would result in loss of hood control.

2) Figure air necessary for combustion.

3) Make sure there is no contamination at source of supply.

4) Care should be taken not to recirculate contaminated air.

A typical air supply system with the methods used to calculate and size the various pieces of mechanical equipment, was described.

A banquet was held Wednesday in the Kellogg Center ballroom. The principal speaker, James W. May, Technical Director, American Air Filter Co., presented a timely address on collecting atomic waste.

He said that industrial ventilation is playing an extremely important part in the AEC program, with exhaust systems of all types employed. The radioactivity of materials necessitates the use of extremely high efficiency collecting systems. Absolute efficiencies of 99.95 percent are required and are being attained.

Mr. Robinson was the chairman for the Thursday sessions.

How To Maintain Maximum Efficiency

J. A. Gavin, Plant Engineer, Ternstedt Div. of General Motors, gave the final talk of the conference — on how to maintain maximum efficiency.

He said that the successful ventilation of a modern industrial plant is dependent on the following factors:

1) Attitude of the plant organization toward ventilation: Management must take an active interest in working conditions throughout the plant and continuously study conditions to determine what can be done to improve them.

2) Maintenance of equipment: Preventive maintenance schedules are necessary, with tests of systems operated.

3) Periodic check of air samples by health officials, who report their findings to management.

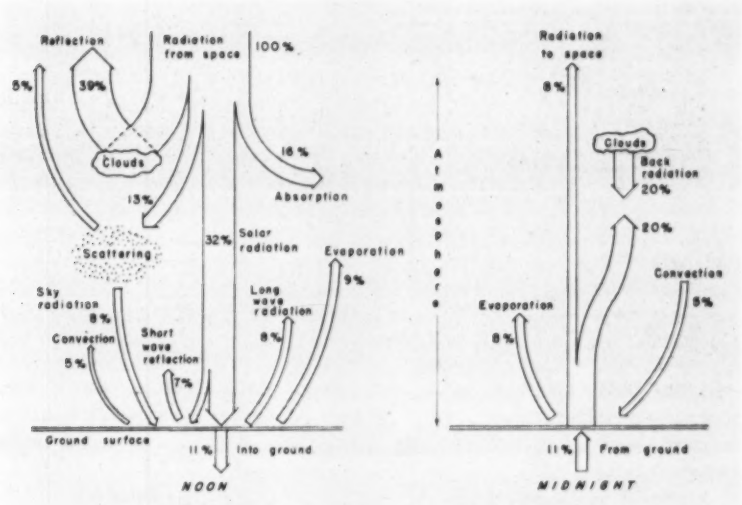


FIG. 1—REPRESENTATIVE SUMMER HEAT exchange in northern part of U.S.

Let's Talk About the Weather

Air conditioning and heating engineers depend greatly on the weather. The author continues his discussion of the weather this month; later, he will consider establishing proper design conditions away from weather stations, and will compare design conditions. Importance of the subject is demonstrated by the case of one large installation, where each increase of 1 deg in wet bulb temperature cost an additional $1 million for air conditioning

By A. Donald Hay

THE EARTH'S PRESENT climatic variations are dependent upon the sun and its atmosphere, and the surface of the earth and its atmosphere[5*]. Contrary to some popular beliefs, the effect of the moon is insignificant. Although the moon causes appreciable tides in the ocean, atmospheric tides are barely detectable and represent a difference of less than one-thousandth of an inch on a mercury barometer, and therefore are inappreciable as a factor in weather change[6].

*Superscripts denote references to appear in last article of this series by Mr. Hay.

It is generally accepted that the sun is the source of all energy which the earth receives. Energy from the stars is insignificant; in fact, the earth receives only one part in 2.2 billion of the energy which leaves the sun.

How Much Energy from Space?

Fig. 1 shows a representative disposition of the solar radiation which reaches our planet. An average of 44 percent of the noon radiation is reflected back into space from the clouds and from dust particles suspended in the air, as well as from the air molecules themselves. A portion of the radiation is absorbed in the upper atmosphere by ozone, water vapor and carbonic acid, increasing the temperature of the absorbing gases. Some of the relatively short-wave radiation from the sun is reflected from the surface of the earth, while some of the solar radiation warms the surface. The warmed surface acts as a radiator of energy having a longer wave length. Convection, and evaporation of water, remove additional energy from the ground surface, leaving about 11 percent to be stored in the ground at noon.

Mr. Hay has had experience in the advanced engineering section of the air conditioning division of a prominent manufacturer, in the air conditioning design section of a well-known firm of consulting engineers, as a teacher of air conditioning in the school of engineering at Princeton University, and as a senior staff engineer at the Franklin Institute Laboratories for Research and Development.

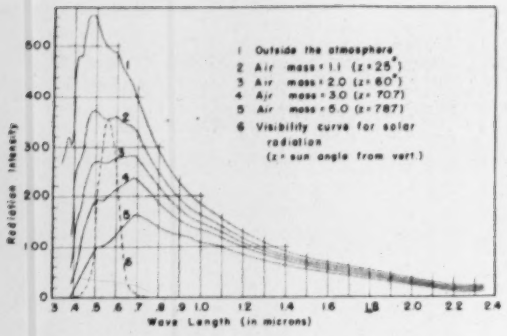

1 Outside the atmosphere
2 Air mass = 1.1 (z = 25°)
3 Air mass = 2.0 (z = 60°)
4 Air mass = 3.0 (z = 70.7)
5 Air mass = 5.0 (z = 78.7)
6 Visibility curve for solar radiation
(z = sun angle from vert.)
Radiation Intensity
Wave Length (in microns)

FIG. 2—THE NORMAL SPECTRAL ENERGY of solar radiation, in gram calories per cu cm per sec

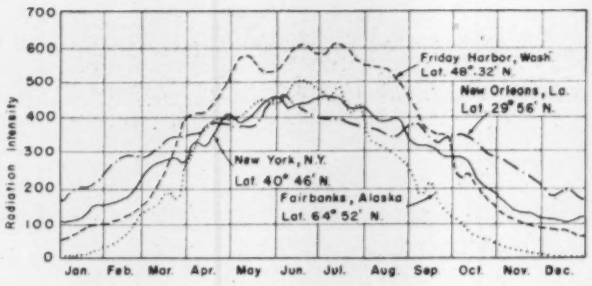

Friday Harbor, Wash.
Lat. 48° 32' N.
New Orleans, La.
Lat. 29° 56' N.
New York, N.Y.
Lat. 40° 46' N.
Fairbanks, Alaska
Lat. 64° 52' N.
Radiation Intensity
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep Oct. Nov. Dec.

FIG. 3—AVERAGE DAILY TOTAL SOLAR and sky radiation (in gram calories per sq cm per day) on a horizontal surface

The heat balance at midnight is quite different. Fig. 1 shows this to the same scale. The radiation from space is missing, and the energy radiated from the ground has a relatively long wave length which is not very penetrating. When clouds are present, this radiation is almost completely reflected back to the ground. Combining the heat balances at noon and midnight, one may visualize the local effect caused by several consecutive days having a clear sky during the day and cloudy skies at night. Energy readily reaches the ground during the day but has difficulty escaping at night, causing a rise in the air temperature. The opposite cloud condition would cause a drop in air temperature.

The behavior of radiant energy depends upon the wave length of the radiation. A knowledge of the distribution of the solar radiation throughout the spectrum is therefore necessary for the understanding of the conditions produced by this energy. The intensity of solar radiation is shown in Fig. 2 as a function of its wave length[7]. The proportion of the radiation which is visible to the eye at noon during the summer in the United States is shown as a dashed line. It may be observed that as the sun nears the horizon, the peak of the radiation curve, and the visible portion of it, shift toward the infra-red end of the spectrum. This agrees with our experience.

Meteorologists are interested in the portion of the spectrum shown in Fig. 2, the portion of high-intensity solar radiation. Not only does the intensity of solar radiation decrease outside of this range, but ozone, water vapor and carbon dioxide absorb large portions of the radiation before it reaches the ground. The ozone in the atmosphere absorbs much of the ultraviolet radiation before it reaches the ground. Water vapor and carbon dioxide absorb little of the solar radiation, but do absorb much of the long wave radiation from the earth as it tries to escape. They absorb radiation in bands. The first important absorption band for water vapor is at 3 μ, a more effective band between 5 and 9 μ, and it is very effective in absorbing radiation with wave lengths above 12 μ. Carbon dioxide has sharp but narrow absorption bands at 4.3 and 14.7μ[8].

"Albedo" Is Reflectivity of a Substance

When the solar radiation finally reaches the ground, some of it is reflected from the ground surface and the remainder is at least temporarily absorbed. The percent of the solar radiation which is reflected from a substance is called the reflectivity or "albedo." If the albedo for a substance is 80 percent, then 80 percent of the insolation is reflected from its surface and 20 percent is absorbed. The albedo of substances is very much a function of the wave length of the insolation. For practical purposes the albedo of the substances in Table 1 has been listed under the three main spectral divisions, showing the approximate percent of the total insolation falling into each division.

Familiar sensations may be explained in the light of this table. Certain bands of the ultraviolet radiation are responsible for sunburn and irritation of the eyes. The visible spectrum is narrow and easily

TABLE 1—REFLECTIVITY or albedo of certain substances[9 through 18]

Ultraviolet Spectrum (4% of insolation)	
Fresh snow	80-85%
Gravel, granite, chalk	22-25%
Dry dune sand	17%
Garden soil	6%
Water	5%
Green leaves and plants	2-10%
Visible Spectrum (45% of insolation)	
Fresh snow	80-85%
Cloud surface	60-90%
Old snow	42-70%
Dry dune sand	37%
Wet dune sand	24%
Dry grass	32%
Wet grass	20%
Dry concrete	20-28%
Fields and meadows	15-30%
Heath sand	10-25%
Green leaves and plants	8-20%
Forests	5-18%
Sea	8-10%
Infra-red Spectrum (55% of insolation)	
Green leaves and plants 0.8 μ	45%
1.0 μ	42%
2.4 μ	9%
10.0 μ	5%
Dry concrete	29%
White sand	11%
White limestone	8- 9%
Coarse gravel	8- 9%
Earth clots with sod	2%
Fresh snow	0.5%

sensed. Our eyes are especially sensitive to the color of green. The infra-red is predominantly a heat radiation to which the skin is somewhat sensitive, especially when tender. Table 1 indicates that the infra-red radiation reflected from green leaves and plants is from two to five times that of the visible radiation reflected, although the leaves appear green and not very bright. A photographer, however, knows that living leaves look very white in a picture taken with film sensitive to infra-red light. If our eyes were sensitive to all of the wave lengths shown in Fig. 2, a forest would appear infra-red in color and the shade beneath the trees would be the same color, for in addition to the albedo the leaves have a higher permeability for infra-red than for green. This phenomenon is known to the careful observer, for the color of the shade beneath the leaves in the woods is warmer than the blue shade beneath the open sky.

Reference to the albedo of freshly-fallen snow shows the reverse condition. In the visible spectrum it is very bright while in the infra-red spectrum ($\mu = 10$) it is almost the "blackest body" that we know. If your hand is held over fresh snow it will appear quite white but will feel very little infra-red reflected heat. If, however, your hand is moved until it is over dry concrete, it will not appear as white but the infra-red reflected heat will be felt. Differences in the albedo of the earth's surface cause local heating of the air above certain surfaces. This causes updrafts, resulting in the displacement of large masses of air and often resulting in the formation of a cloud when the air is cooled and moisture condensed at higher altitudes.

The farmer needs to study the albedo of his property in order to prevent frost from killing his fruit and vegetables.[19] He may increase the ground temperature and air temperature near the ground at night by choosing a slope which faces the sun, by removing any grass cover which prevents the sun from storing heat in the ground during the day, by leaving the soil tightly packed (a better heat conductor than loose soil), by covering the plants to reduce the outward long-wave radiation, or by setting out smudge pots which provide both radiant heat, which acts as an energy source, and an artificial smoke cloud, which acts as a blanket for the heat stored in the ground.[20]

The comfort of an open porch depends greatly upon the control of solar energy. A porch may be cooled by shading it during the day and covering the surrounding ground with a grass cover. If a porch becomes too cool in the evening, it may be made warmer by causing solar heat to be stored in adjacent rocks or bare ground during the day to be released in the evening, and by covering the porch with a ceiling which will return the ground heat to the porch.

Variation in Radiation Explains Weather

The variation in intensity of the solar and sky radiation throughout the year has been studied by the U. S. Weather Bureau for half a century, and the results help to explain our weather conditions. This variation is shown in Fig. 3 for four cities[2] which differ in latitude in steps of approximately 10 deg.

During the winter, as might be expected, the intensity of radiation falls off quite regularly with increase in latitude. This has a pronounced effect on the winter temperature.

The intensity of the total radiation is very nearly constant near sea level in the United States, and may be represented by the curve for New York in Fig. 3. The West Coast is the only exception to this, and there the summer radiation at sea level is that of Friday Harbor. This increase in intensity is due to the relatively dust- and cloud-free air which blows in from the Pacific.

The intensity of total radiation also increases with altitude as the air and dust offer less resistance to the flow of heat. At Twin Falls, Idaho (altitude 3730 ft), the total solar radiation is 10 percent above that at Friday Harbor during May, June and July. Because of these relations it might be predicted that the summer temperature throughout the United States is more uniform than the winter temperature, and that the temperature variations are a function of topography rather than latitude. The isothermals have little tendency to parallel the latitudes, and while the difference in summer temperature between New Orleans and Duluth is 0 F, the winter difference in temperature between the same two cities is almost 55 F.

Earth's Temperature Hasn't Varied Much

Geologists tell us[5] that it is fairly certain that for at least several hundred million years the average temperature of the surface of the earth has never varied more than 50 F above or below its present temperature, and this range may be double or triple the range which has actually occurred.[22] Although this does not eliminate the possibility of cycles, it does indicate that there is a negligible drift in the average temperature of the earth's surface.

During the billion and a half years of geologic history, there have been at least four major glaciations at intervals of about 250 million years. These glaciations or ice ages have been in existence about 1 percent of the time, and at present we are observing the recession of the latest ice age.[21] A rise of 2 F in the temperature of the earth now would be sufficient to clear polar seas of all ice.[22] During an ice age the movement of the ocean water is restricted, causing greater extremes of world temperatures than when free circulation exists. The air temperatures during this period fluctuate erratically as some air masses move toward the equator from the ice-capped polar regions. This causes erratic precipitation. In contrast to this, climate is more uniform and predictable between periods of glaciation.

The pattern formed by the distribution of types of climate over the surface of the earth is a reflection of the nature of the general circulation of the atmosphere. Air is heated near the equator, expands and cools upon rising, precipitates much of its moisture, and flows toward the poles. The cool air near the poles moves toward the equator near the ground. The earth's rotation deflects air toward the right in the northern hemisphere and to the left in the southern. In addition to this, friction produced by the earth's surface causes modifications in the flow pattern. The result is a series of belts with prevailing east winds in the polar regions and near the equator, but west winds in the middle latitudes.[21] This pattern is altered by the continents, which heat and cool more rapidly than do the oceans. A

warm continent heats the air above it, producing an updraft of air, and causes the cool air to follow another route. These air currents cause the annual precipitation to vary enormously over the earth, the minimum being less than 1 in. and the maximum in excess of 900 in. The rainfall affects the vegetation and the temperature of the region, and this in turn affects the precipitation.

The inter-relation between insolation, albedo, wind and evaporation or precipitation, sets up temperature fluctuations in a given region. Two of these fluctuations are recognized as cyclic in variation; they are the diurnal (or daily) cycle, and the annual cycle. Lists of from 50[23] to 130[24] climatic cycles, varying in length from a few days to nearly two centuries, have been compiled. Astronomers predict much longer cycles, such as the 26,000 year cycle coinciding with the precession of the equinoxes.

The methods of analysis for weather cycles are tedious[25,26] and although one may "fit an equation" or curve to the existing data, it is questionable whether it may be projected into the future to forecast weather conditions. The diurnal and annual cycles must be considered in the design of air conditioning equipment. Other cycles and combinations of cycles predict temperature fluctuations which rarely amount to as much as 3 F. Perhaps the most famous is the Brückner cycle of 35 years, but this cycle has an amplitude not exceeding 2 F, and the length of the cycle may vary between 20 and 50 years.[6] R. J. Russell† has summarized the work on cycles as follows:[24]

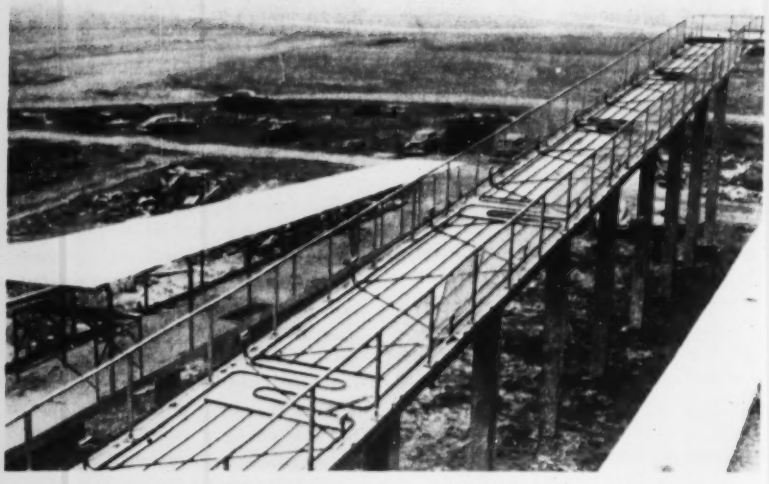
†Professor of Physical Geography, Louisiana State University; collaborator, Soils Conservation Service.

"Though firm advocates of climatic cycles will sharply disagree, such facts as we possess today neither definitely demonstrate nor disprove the existence of any real cycle. Such climatic variability as has been observed may be explained as resulting wholly from random fluctuations."

The lowest temperature of record anywhere on earth is −90 F at Verkhoyansk, Siberia, February 5 and 7, 1892, while the highest is 136 F at Azizia, North Africa, September 13, 1922. In the United States the lowest temperature of record is −66 F at Riverside Ranger Station, Wyoming, February 9, 1933, while the highest is 134 F at Death Valley, California.[21]

[Mr. Hay's article in the March HPAC discussed Measuring the Weather. Future articles by him will be devoted to climatology of the United States, micrometeorology, and analysis of weather conditions to achieve air conditioning economy.]

Airport's Pedestrian Ramp Has Snow Melting



PEDESTRIAN RAMP for Philadelphia's airport terminal building has a snow melting system to keep the 10 percent slope hazard-free all year 'round. Water for the snow melting system is heated by steam, using the same boiler plant used for a radiant heating system inside the building.

Among the features of Philadelphia's new $8 million international airport is an outdoor ramp leading to the observation deck, which completely bypasses the interior of the building to relieve much of the congestion that results from having to funnel passengers and visitors through the same area.

The floor of the ramp has a built-in snow melting system of embedded wrought iron pipes. A heated solution of water and antifreeze coursing through the pipes will keep the 10 percent slope free of the hazards of snow and ice.

A. Ernest D'Ambly is the consulting mechanical engineer.

GROUP DISCUSSES HOSPITAL PLANNING

A group of hospital officials met in Washington recently with representatives of the government and the American Institute of Architects to discuss the formation of a central research organization for hospital planning. The meeting was under the joint auspices of the American Hospital Association, the American Institute of Architects, and the Building Research Advisory Board of the National Academy of Sciences.

The main function of this central organization would be to conduct actual research on hospital planning and to stimulate research activity among allied agencies. Another function would be to distribute up-to-date technical information on hospital design and planning.

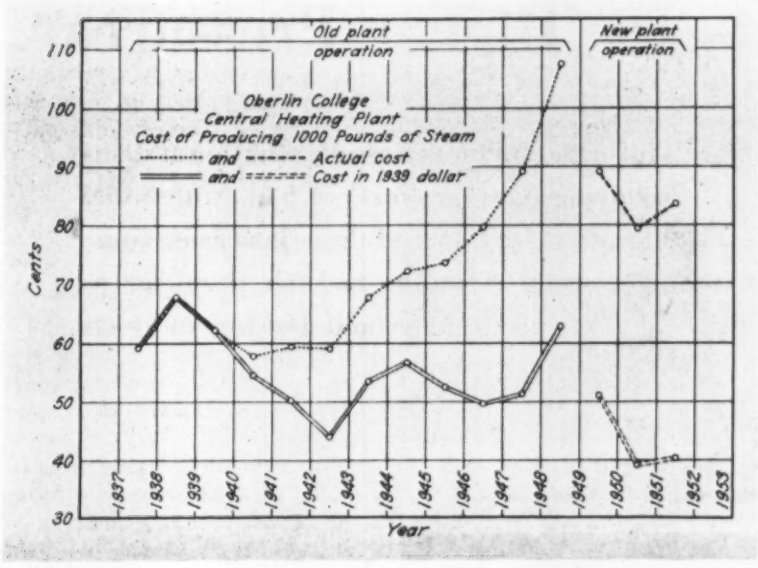


CHART SHOWS

Heating Modernization Pays

New central boiler plant for heating Oberlin College has reduced the cost of steam

By Lester S. Ries, Superintendent
Department of Buildings and Grounds
Oberlin College, Oberlin, Ohio

WHAT WOULD YOU DO if you were a trustee of a liberal arts college which was faced with a major heating plant problem? The problem at Oberlin College some years ago was whether to add another boiler to the existing battery of three, or to appropriate sufficient funds for the development of a new and modern heating plant.

The average college trustee generally is one who has a keen interest in education and who has been successful in business. Few trustees — in a liberal arts college, at least — have training or experience in engineering. Yet, whatever the background of a college trustee, engineering decisions must be made. Even with the best engineering advice, the college trustee must take the responsibility for final decisions.

Old Boilers Functioning — But Being Pushed

At Oberlin, the original boilers were installed in the central heating plant in 1913 and had been under the watchful care of competent staff. There had been no interruption of the heating in the college buildings due to boiler failure. It is true that, because of building expansion, the original boilers were being pushed to capacity and high fusion coal was required in order to deliver the amount of steam necessary during the latter years of their use.

But even so, the boilers were functioning and things were "running along." Classes were in session, experimental animals were adequately housed, and as far as anyone knew, the mounting cost of steam production was the only evidence of inadequacy. That is the situation that faced Oberlin's board of trustees during the winter of 1947-1948.

As outlined in the July 1950 issue of Heating, Piping & Air Conditioning, the new boiler plant was erected and began its service in the fall of 1949. After three years of operation, it is interesting to see whether or not the decision of the trustees (and their engineering advisers) to erect a new central heating plant was wise.

Cost of Steam With New Plant

In order to determine the merits of the new boilers, the cost of producing 1000 lb of steam has been used as an indicator. However, there is no way of knowing, after abandoning the old plant, what costs would have been experienced had the old plant remained in operation. In order to approximate the relationship between the two installations, the accompanying graph will prove useful. The upper curves show the cost of producing 1000 lb of steam for each of the years shown. The lower curves show the cost of steam had the value of the dollar remained stationary over the entire period (based on the 1939 purchasing power.)

Other factors also affected the decision. They were mostly in favor of abandoning the older installation because of advancements made in equipment utilized in steam production since 1913.

Results Indicate a Wise Decision

One of the principal responsibilities of a college board of trustees is that of having sufficient endowment funds available for operating budgets required to successfully carry on the education program of the college. A reduction in the cost of producing steam is of the utmost importance, thereby resulting in a lessening of budget funds.

Based only on the evidence of three years' operation as shown on the graph, it is evident that, in replacing the 1913 boiler installation with modern steam generating facilities, a wise decision was made.

Installing Ducts for Higher Pressures

Here's information on two air distribution systems involving static pressures of 6 in., with initial velocities of 2500 to 3000 fpm. Out of these jobs came some effective and unusual solutions to such problems as air leakage and bowing of ducts

By Lawrence O. Paul
Narowetz Heating & Ventilating Co.

THE NAROWETZ Heating & Ventilating Co. recently completed two duct installations using the high pressure type of air distribution. Both jobs were designed for stores in the new Evergreen Park shopping plaza at 95th St. and Western Ave., Evergreen Park, Ill., a suburb of Chicago.

6 In. Static Pressure

The first job was for the Fair Store, a four-story branch department store of approximately 40,000 sq ft per floor. Four fan systems located on the first and second floors serve the entire area. These fan systems are the same as any standard built-up system from the outside air intake to the fan suction. That is, they consist of the usual heaters, filters, cooling coil section, casing and drip pan. Here the similarity stops. The fan, instead of operating against a head of approximately 2 to $2\frac{1}{2}$ in. static pressure, operates against a head of 6 in. static pressure and with initial velocities of 2500 to 3000 fpm.

The ductwork had to be built to withstand the added pressure on the fan discharge, and to take into account the higher velocity used. These systems were designed with the use of galvanized iron sheets in mind, but because of the steel strike and shortage of materials, it was de-

FIG. 1—THE MAIN supply duct on the first job is 150 ft long, and was run at one side of the floor in the service area

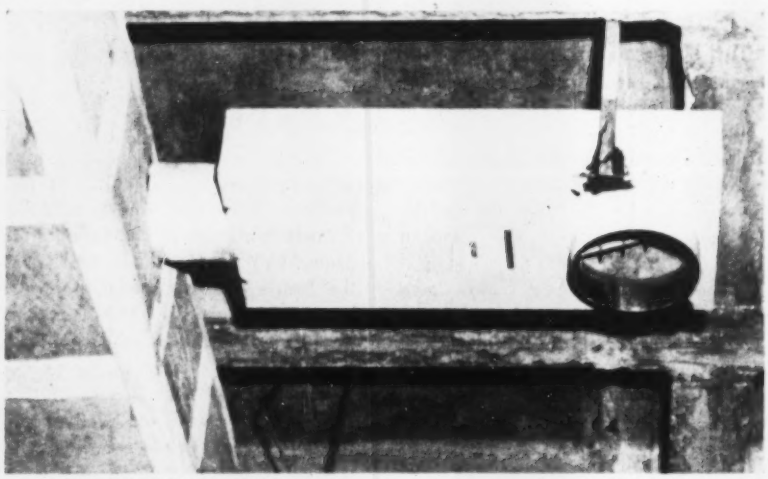


FIG. 2—RIGID CONNECTIONS were made between the sound absorbing boxes and the main ductwork. The boxes were cut into the branch runs after erection of the entire run

cided to use flat aluminum sheets for the ductwork, and galvanized iron for the casings and some fittings and ductwork in the fan room where ducts might be subject to abuse.

The ductwork was to be rectangular and cross broken for rigidity. Since aluminum was to be used, a test mock-up section of ductwork was constructed in conjunction with the design engineers. The duct was approximately 46 in. x 18 in. x 8 ft long, cross broken on all sides from the 8 ft corners. No. 0.041 aluminum was used. Angle iron frames were installed at the 4 ft points.

Under pressure, the duct sides tended to become elliptical. At 3 in. of static pressure, the 46 in. sides were bowed out approximately 1½ in.; at 4 in. static pressure, the sides were bowed to approximately 2 in., and at 6 in. of static pressure the duct bowed to 3½ in. at the greatest arc of the bow. The Pittsburgh lock seams showed no signs of pulling apart.

The duct was redesigned with welded angle frames and cross broken every 4 ft. The next test showed that at 3 in. of static pressure, which would be the normal operating pressure, a bow of less than ½ in. on the 46 in. side was noted. This was considered to be within allowable limits for the large ductwork, and construction proceeded on this basis.

Reducing Joint Leakage

The ductwork was made as per standard shop practices, but since leakage in a high pressure system can become a major problem, every possible effort was made during erection to keep joint leakage to a minimum. Standard joints with welded frames every 4 ft were used, with mastic cement being put in the joint before the following piece was connected. Then more cement was placed on the outside before the drive cleat was driven into place. To make certain that all joints on the supply side were as tight as possible, one man was assigned to check all duct runs.

Because of headroom requirements and the floor construction,

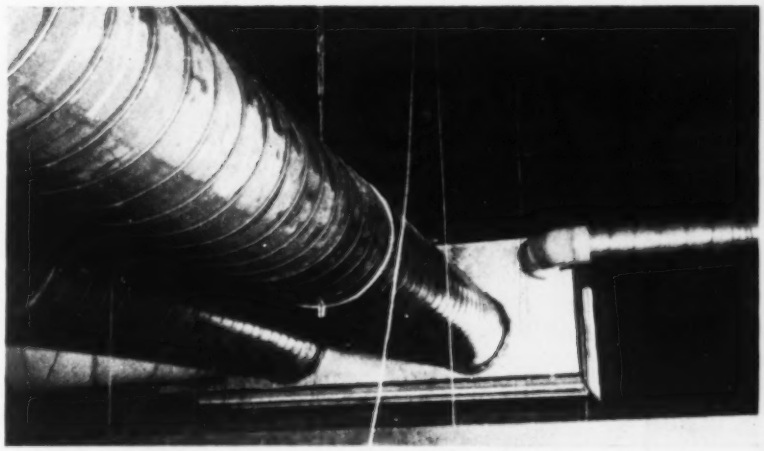


FIG. 3—FROM THE SOUND ABSORBING plenum on the second job, the 24 ga spiral duct was run to the designated areas

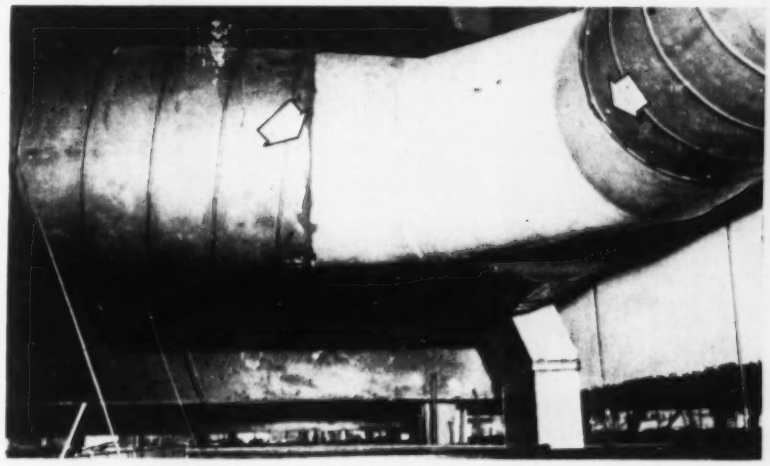


FIG. 4—JOINTS WERE SECURED with sheet metal screws (see arrows) after special sealing compound was applied and the coupling inserted into the pipe. Branch take-off is at lower right

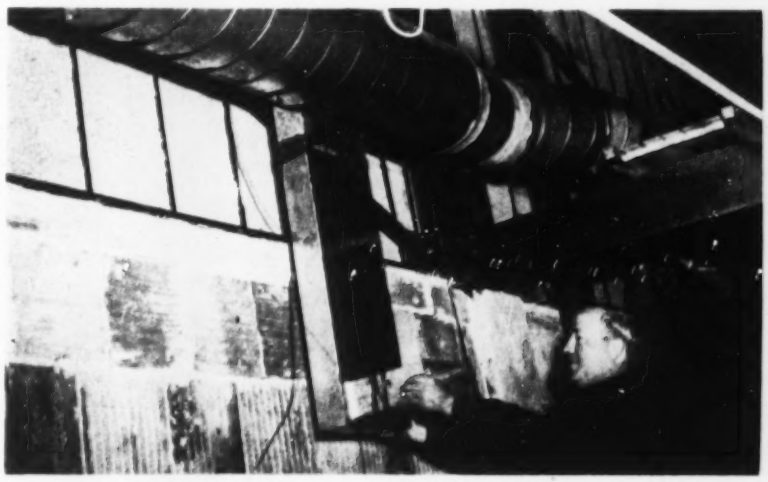


FIG. 5—OUTLET COLLARS were taped into the 20 in. main above the ceiling. No splitters or dampers were used

FIG. 6—THIS WORKMAN spent his full time sealing joints to prevent air leakage in these "semi-high" pressure systems

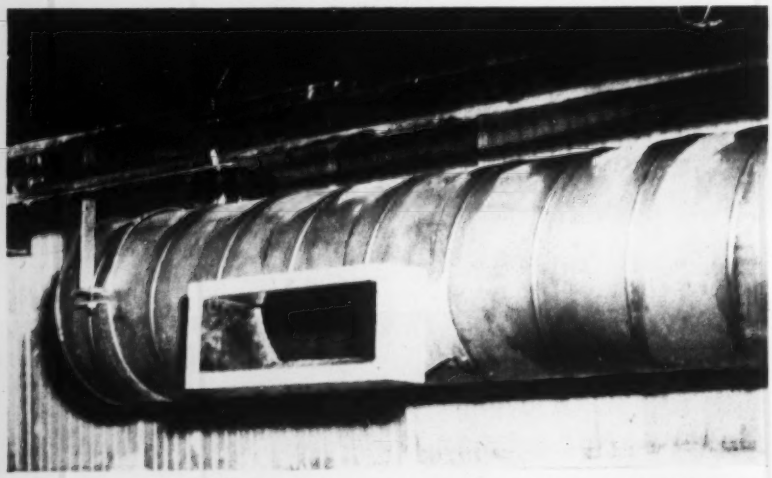


FIG. 7—WHEN DUCT WAS run below furred ceiling, outlet connections like the one shown were made. The ceiling was furred down to enclose the outlet collar and duct

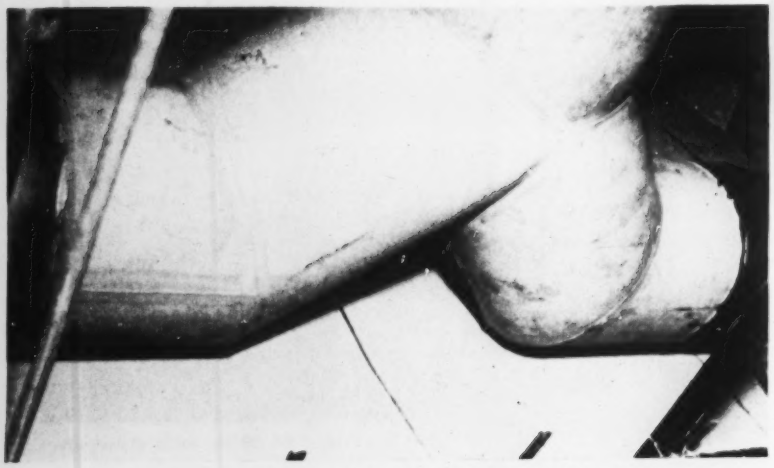


FIG. 8—AT BRANCH RUNS, "Y" fittings like this were used

the main supply duct was run at one side of the floor in the service area. Ducts were then run from the supply main as shown in Figs. 1 and 2. These ducts are the same size from the take-off to the end of the run, approximately 150 ft in length.

Sound Absorbing Boxes

The sound absorbing boxes for the outlets were cut into the branch runs after erection of the entire run, and were spaced in accordance with the architectural layout.

In addition to the sound absorber boxes installed at each supply outlet, sound absorbers were installed on each supply main between the fan and the first outlet. They were also installed in a similar manner on the standard construction return air ductwork. These sound absorbers are 10 to 27 ft long, with 2 in. of muslin covered fiber glass installed on the perimeter of the duct section. To prevent the material from being torn loose by the high velocity, it is held in place by expanded metal over the entire area.

Since having been placed in operation, the aluminum ducts have proved to be satisfactory with the construction described above. Labor costs were approximately the same as for a standard design job. Erection costs were higher because of the extra labor involved in sealing joints and checking, but fabrication costs were lower because of the quantities of similar sized ductwork. The main thing to remember in doing a job of this type is to prevent leakage, especially if the ductwork is not in the conditioned area.

Round Ducts for Second Job

The other job was installed for the Carson, Pirie, Scott & Co. two story branch store located in the same shopping area. This job uses unitary equipment and round ductwork.

One system was located in the fan room of the ground floor, along with the refrigeration equipment, and the other unit was located in the furred ceiling of the first floor in the truss space. The supply units in each case

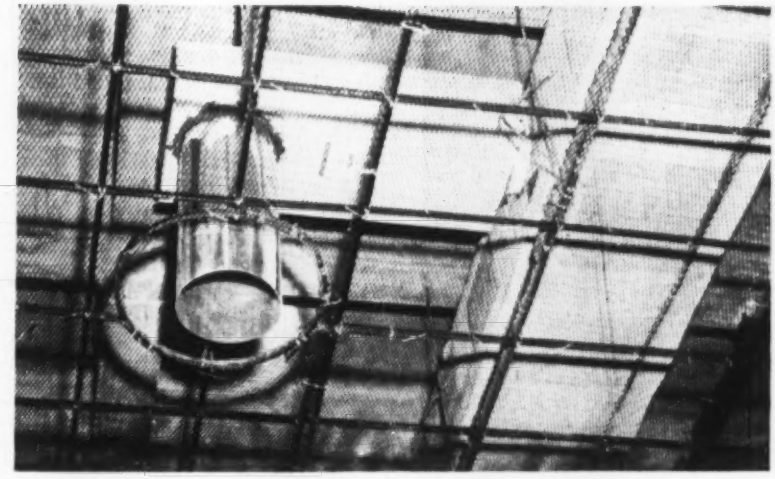


FIG. 9—AN EXTENSION COLLAR on a sound absorbing box, part of the Fair Store job, is shown here with metal lathing in place

discharged into a sound absorbing plenum, which on this job consisted of a rectangular box lined with ½ in. of sound absorbing insulation. From these boxes, the round ductwork, as shown in Fig. 3, ran to the designated areas. This ductwork is 24 ga spiral duct. It was delivered in 20 ft sections, and since some of the ceiling was already installed, the hanging was a difficult job. However, it was all placed in the ceiling with a minimum of cutting. When sections had to be cut, a power shear was used.

Joints were made with a special coupling furnished with the ductwork. These were about 12 in. long with a raised shoulder in the middle. Where possible, the coupling extends 6 in. into the pipe for support. However, this piece can be used to take up variance in the run of duct, so that a small joint does not have to be made. In assembling, a special sealing compound is applied and the coupling inserted into the pipe. The joint is then secured with sheet metal screws (Fig. 4).

No Dampers Used

Grille collars were tapped off the main duct, as shown in Fig. 5. No splitters or dampers were used. This was because, first, the high pressure system of air handling was used, which assures air to every outlet (similar to blowing into a glove to fill up every finger with air), and second, the ductwork would be furred in, and there would not be any way to operate the dampers. All grilles are 12 in. x 4 in. double deflection, and the collars of equal size are bull-headed into the main.

Return air for this job was handled through standard ductwork, except on the first floor where the return air was gathered to a central point through standard ductwork, and from this point to the fan equipment high velocity was used. The gathering plenum was insulated for sound in the same way as the supply ductwork.

The 24 ga round spiral ductwork was found to be very rigid and capable of standing pressures higher than those used on the job. Erection costs were about the same as for any similar round pipe job. The cost of the 24 ga spiral duct as purchased from the manufacturer was found to be equal to similar sizes fabricated at the shop from 22 ga galvanized iron, which gages were thought necessary for the pressure used. The contractor's formed duct was not spiral fabricated.

Although these types of jobs are usually referred to as "high pressure jobs" the Narowetz organization likes to refer to them as "semi-high pressure jobs." They should not be confused with other specific types of high pressure systems used for multistory buildings.

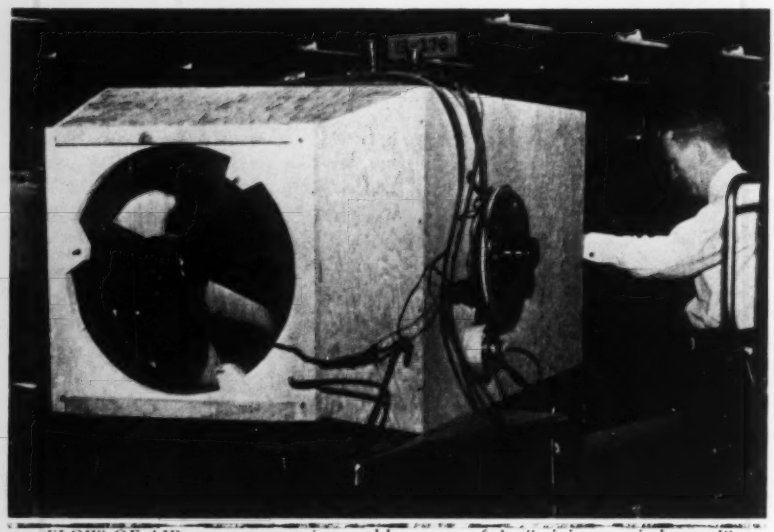
Robert McAuley was the superintendent for the Narowetz Heating & Ventilating Co. on both of these jobs. Since he had already installed a complete high pressure job at Sinclair Refining Corp., he is asking, "How many more variations can there be?" Actually, those who installed this system think the variations are unlimited and require only a little extra thought to be brought into use.

Holabird & Root & Burgee were the architects and engineers on each of these projects, and H. P. Reger & Co. was the heating contractor.

"CANNED" MOTORS PUMP WATER IN ATOM SUB ENGINE

MOTORS DRIVING hot water circulating pumps for a nuclear reactor are — literally — canned, according to Westinghouse Electric Corp. The squirrel cage rotor is contained in a shrink-fit jacket of steel. It turns within a stator that likewise is fully enclosed in stainless steel. In this type of motor, the term "air gap" cannot be used as it is a combination of water and two layers of metal. Both the stator and the rotor are encased in stainless steel, and the space between is filled with flowing hot water — the same fluid that is being pumped through the reactor circuit.

As with most of the components of the reactor circuit, leakage must be small. Hence the motors cannot drive the pumps through seals. The rotor must be contained within the fluid circuit — and obviously is continuously exposed to water that is hot both as to temperature and radioactivity. To prove tightness, the stator enclosure is tested with the most sensitive leak detector obtainable. The space to be occupied by the rotor is filled with helium under a high pressure and with the stator volume evacuated. The bearings also are inside the stator and are lubricated by water.



FLOW OF AIR across a press is tested by means of the "miniature wind tunnel"

What's Right Air Movement in Offset Press Rooms?

By F. F. Stevenson

IT IS WELL KNOWN THAT air movement in offset press rooms is a critical question when ventilating or air conditioning a printing plant. Special consideration must be given to the air flow across the press plates. The plates — particularly lithoplates — are extremely sensitive to air flow, because they dry very easily and quickly when subjected to excess air; and when dry, they are ruined for further use. Also, the pressmen are sensitive to temperature and air movement — like everyone else.

From the standpoint of production, a dry bulb temperature of approximately 75 F the year 'round, with a relative humidity ranging from 50 percent down to 42 percent (with the dryer condition being preferred in the winter) seems desirable. The amount of moisture provided in the paper by the manufacturer has a considerable bearing on humidity requirements.

Mr. Stevenson is a design engineer who has had a wide experience in air conditioning work with several of the large engineering and architectural offices.

No Definite Data on Desired Air Velocity

However, the optimum air movement requirement seems to vary considerably. I have recently checked an air conditioning system for a press room where there was dissatisfaction with the air movement across the presses. In checking with the technical men in charge, so as to get some idea of the air velocity which could be tolerated, figures were given which varied from practically still air up to several hundred feet per minute.

Upon closer questioning and checking, I came to the conclusion that their judgment of the actual velocity of various air flows was vague, and it would be difficult for them to distinguish a flow of, say, 100 fpm from a flow of 250 fpm. One opinion was that the flow could not be greater than 75 fpm — but no one wanted to be pinned down to a definite figure.

The internal sensible heat gain in a press room is high and even with a large temperature split between the space air and the supply air, the air requirements are so great that the number of total air changes is very large. This, of course, makes a low air movement difficult and expensive to attain. Some presses are very high — 10 ft up from the floor, for example — which also complicates the problem.

I reasoned that if some practical means could be devised to create an air flow at the press, which could be operated for several hours at a time, and with arrangements to vary the air flow, it would be possible for the operators of the presses to get an actual demonstration of the effect of the various air flows on the plates and the paper. Then they should be willing to venture a definite requirement.

Miniature Wind Tunnel Built for Tests

A miniature wind tunnel was therefore built of light plywood — a sort of a plenum duct section — with the outlet 2 ft square and the inlet tapered down to accommodate a 12 in. propeller fan of the type used in homes or offices. The overall length of the tunnel is about 5 or 6 ft and it is light enough to be moved about readily.

As it was desired to obtain considerable variation in air volume, a fan with a d-c motor was selected, with a rheostat placed in the circuit, affording about 30 steps of speed adjustment. As the plant current is a-c, a small rectifier was used on the input to the fan motor.

With this device, it was possible to obtain air flows of from several hundred feet per minute down to a flow of almost negligible proportions. Air velocity was measured with a direct reading air velocity meter and with an anemometer.

To operate the miniature tunnel, it was placed on a fork lift truck, brought to the press at which a test was to be made, and lifted to the height desired. Time of the tests averaged several hours each.

After a number of test runs were made, it was found that the actual

air flow which could be tolerated was considerably greater than was at first thought. This was because the operators did not have a true picture in their minds of what a flow of 100 fpm meant and how it differed from 200 fpm — a common enough fault even for ventilation experts.

It was finally decided that air velocities of about 225 to 250 fpm could be used over the average press, which is decidedly different from 75 to 100 fpm when designing and estimating the cost of an air distributing system.

Delivering Air To the Press Room

For delivery of air to the space, a good ceiling diffuser, with a high aspirating potential, was decided upon. When the press is high and close to the diffuser, I would prefer one with six cones to get optimum aspiration and a quick rise in temperature of supply air. For less critical conditions, a five cone diffuser may be used. These may be installed on the bottom of exposed duct work. As they project down below the duct, the depth of the supply duct must be shallow, if the headroom is not generous. Where air flow is not too critical, a four cone diffuser, installed flush with the duct work, may be the answer.

If I were designing a press room from scratch, I would make sure that the ceiling heights were such that there would be at least 2 ft of headroom between the bottom of the ceiling diffuser and the top of the press.

Suspended ceilings are expensive, but the furred space above them provides an excellent path to run the ducts and keep them out of the way of the presses.

Means of Getting Air Out Important

With the air volume running up to 20 air changes per hour or more, in some cases, a means of getting the air out of the room must be carefully studied. The average press room has large double swinging doors, which are used quite often for bringing in paper supplies or taking out the finished product. The exfiltration of room air is therefore considerable.

I doubt if it is possible, in the average press room installation, to return much more than 85 percent of the air supplied, so I would size the return system for this amount of air. With this arrangement, 15 percent of the supply air is taken from the outside as make-up air. Considering the large volume of total air used per square foot of floor area, this amount is ample for ventilating purposes and should meet most code conditions.

Return intakes should not be too far away from the source of supply, for the heat load is highly concentrated and the cool supply air comes up to space temperature quickly. After the air has reached space temperature, it is of no further use and should be gotten out of the room as expeditiously as possible. If it is not, air volume builds up quickly in the critical press area and increases the velocity of air movement to a point where it may be disastrous to the success of the installation.

In press rooms where air flow must be kept at a minimum figure, I would recommend returns in the press area itself at floor level. Where higher air flows may be tolerated — say 200 to 250 fpm — the returns may be farther away and perhaps close to the ceiling.

For the summer months, the design of 85 percent return air and 15 percent outside air is entirely satisfactory; it imposes a minimum load on the refrigeration equipment and affords ample ventilating air. But for the winter months, it may not be satisfactory at all. The principal cooling load of a press room is the internal sensible heat, lights, people, motors, hot water sprays on the presses, and the like. This does not vary through the year. The only difference between the summer and winter internal loads is the difference between heat gained through walls, windows and roof in the summer and heat lost through the structure in the winter.

Supply Air Temperature in Winter, Summer

With a well constructed tight building, and with the roof properly insulated and perhaps being sprayed with water in the summer, the difference in the transmission load during summer and winter is small in proportion to the total cooling load. It may well be that there is a cooling load in winter, even with the outdoor temperature reading minus 10 F. If the temperature split for the maximum summer load is 20 F, and the design space temperature is fixed at 75 F the year 'round, then the supply air temperature will be 55 F.

It would be highly desirable to have the air temperature lower than this, because the lower the supply air temperature, the lower the air volume, duct dimensions and fan sizes. But with the air diffusers close to the presses and the pressmen being susceptible to cold drafts, it may not be advisable to go any lower. In addition, an air supply at 50 or 48 F would require the refrigeration machine to operate at a low suction temperature, which has an adverse effect on its capacity.

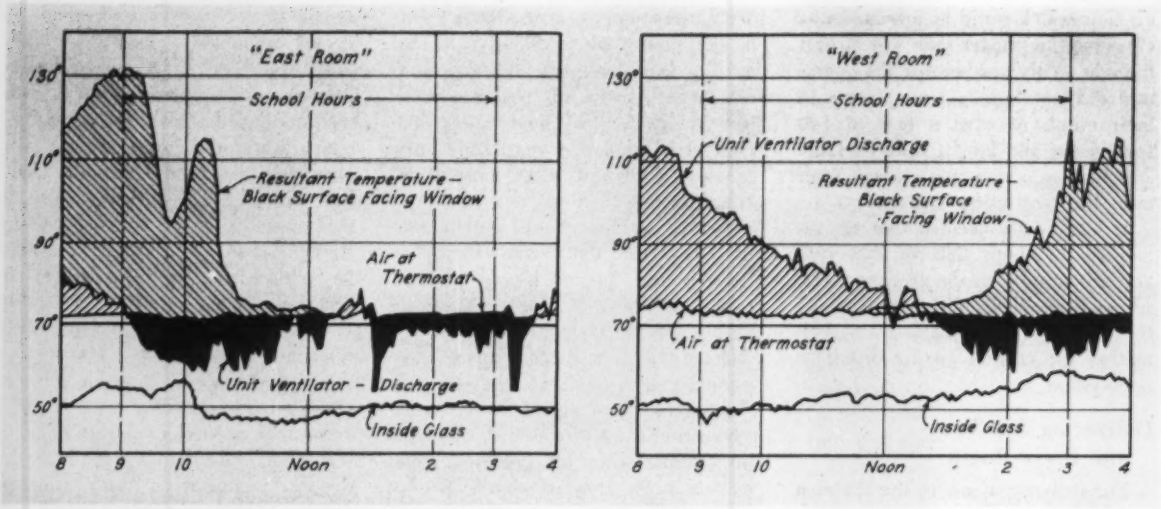
So, with a summer design of 55 F supply air, the cooling load in the dead of winter might require a supply air temperature of, say, 65 to 70 F. This being the case, the temperature of the air mixture in the fan plenum, with an outside temperature of 25 F, would be approximately 68 F. If the cooling load at this time required 65 F supply air, then the refrigeration machine and cooling tower would have to be put in operation. This would obviously be an uneconomical arrangement.

Use the So-Called Economizer Plenum?

Therefore, it would probably be best to use a so-called economizer plenum, with two fans, so that in the winter larger quantities of outside air could be used. It is far cheaper to heat 50,000 cfm of air a few degrees than it is to cool it over a similar temperature range.

If an economizer plenum with two fans were used, I would recommend a two-speed arrangement for the fans, so that the air volume could be reduced in the winter in accordance with the lower winter cooling load. With lowered air volume, supply air temperatures of around 53 to 60 F could be used during cold weather and such air could be obtained over long periods of time by the proper mixing of outside and return air.

The control should be arranged so the condition of the air mixture would be such that it could be used untreated, or if that were not possible, it would require only a small amount of heating and perhaps humidification. The mixture should never be such as to require dehumidification, because this would mean starting up of the refrigeration equipment in winter.



EAST ROOM—Cooling (indicated by dark area below 72 F) was required in east classroom for most of school day despite an outdoor temperature ranging from 21 to 38 F. Light area above 72 F is a representation of solar load as recorded by black foil surface

WEST ROOM—Heating (medium shaded area above 72 F) was needed in west classroom until middle of lunch period. Unit ventilator supplied cool air to classroom remainder of afternoon to balance overheating effect of direct solar load

Unit Ventilator Performance

. . . . in heating, cooling classrooms determined by "laboratory school" research studies described at Instrument Society of America symposium

AN ALL-DAY SYMPOSIUM on heating, ventilating and air conditioning controls and instrumentation was held recently under the sponsorship of the Chicago section of the Instrument Society of America. This "first venture" of the ISA section into this subject was quite successful, and the registration was "better than expected." Six speakers were on the program.

An extensive research program on heating and ventilating classrooms — carried out during the winter of 1951-52 in the George Washington school, Moline, Ill. — was described by W. G. Potter, field engineer (who presented the paper) and F. G. Baker, product development engineer, Herman Nelson Div., American Air Filter Co. They stressed that providing the proper thermal environment in a classroom is often a matter of cooling, even in the wintertime.

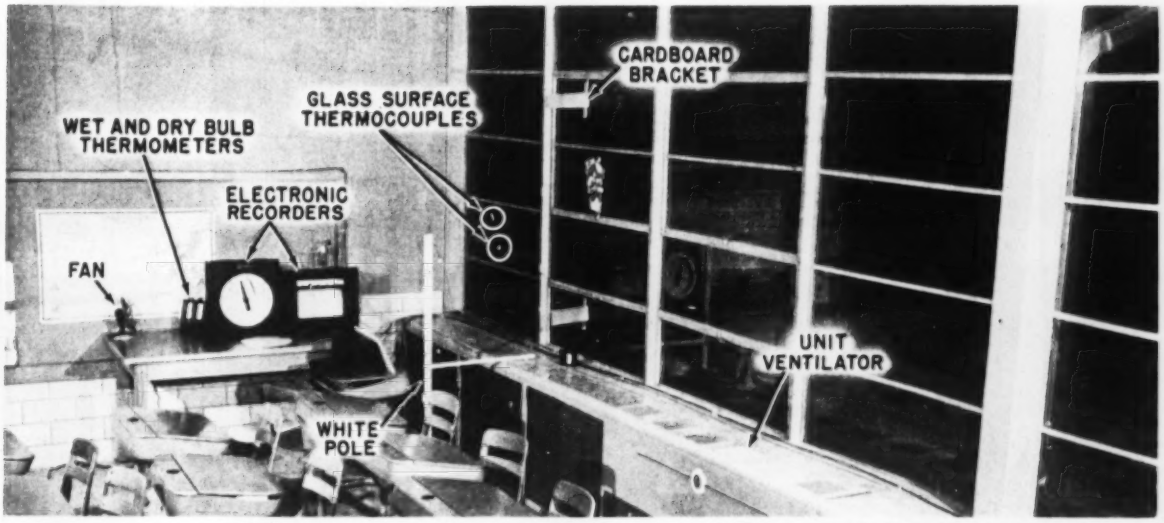
The following paragraphs are a rather complete summary of their paper.

Large Window Areas the Chief Factor

The chief factor influencing thermal conditions in a modern classroom is the large window glass expanse at the outside wall. Through this window surface come floods of direct solar heat when the sun shines; conversely, on cloudy days or at night there is little or no direct heat gain, and the window wall becomes a major source of heat loss. Yet, day or night in cold weather, the inside window glass surface remains cold and cools room air adjacent to the glass. This chilled air flows down the window surface, becoming even colder and finally spills out from the window sill, causing cold drafts and discomfort. In addition, some authorities feel that the cold window surface presents a radiant cooling effect on the pupils in the classroom. (Although this proved true at night, it is not true during most daylight hours.)

It is for all these reasons combined, that the window area presents such an ever-changing heat loss and many times a heat gain factor in upsetting proper room thermal conditions.

It was to see just how effectively a properly controlled unit ventilator could counterbalance all these varying thermal factors to maintain a comfortable room air environment



INSTRUMENTATION FOR the studies made in the west exposure room is shown here. The white pole was used to hold thermocouples for measuring temperatures 1 in., 24 in. and 48 in. above the floor and 18 in. out from the utility cabinet under the window

that prompted this research program.

Thermal measurements were made by thermocouples positioned identically in each of four research rooms and connected to one of two 16 point electronic indicating and recording potentiometers. Both north and south exposure room thermocouples were connected to one potentiometer in the south room; likewise the other instrument was placed in the west room to record east and west exposure readings. In all, almost 5000 ft of thermocouple wire was connected, and over 10,000 temperature readings printed every 24 hr by the two recording instruments.

The outer shell of each research classroom includes three celocrete block walls, one wall of glass, acoustic tile ceiling and linoleum tile floor. To properly evaluate the thermal environment enclosed by this shell, it was necessary to measure (1) *air* temperature within the shell, (2) *surface* temperatures of the shell itself, and (3) solar and window *radiation* effects coming through the shell.

How the Temperatures Were Measured

Air temperatures were measured at 1, 3, 5, 7 and 9 in. distances from the inside glass surface near the ceiling and window sill. Slots for thermocouples were cut into cardboard brackets at the proper intervals and then the cardboard taped to the inside window surface.

Room humidity was recorded constantly by thermocouples attached to wet and dry bulb thermometers with a desk fan supplying proper air motion.

A pole in the aisle was used to hold thermocouples 1, 24 and 48 in. above the floor. Other thermocouples were positioned to measure air temperature at the unit ventilator discharge, in the clerestory space, at the window sill and outdoors.

Thermocouples were used to sample air temperature at the wall thermostats. It was interesting to note, and most thermostat manufacturers are the first to agree, that the little thermometers on thermostat covers often lag 3 to 4 deg behind room air temperature changes.

Inside window glass surface temperature was measured by cementing thermocouples to the surface of the glass. Floor, wall and ceiling surface temperatures were measured by taping a thermocouple to each surface. Since these surfaces normally follow room air temperature quite closely, no special effort was made to imbed these thermocouples into the surface, because the effect of air temperature for the purposes of this study was negligible.

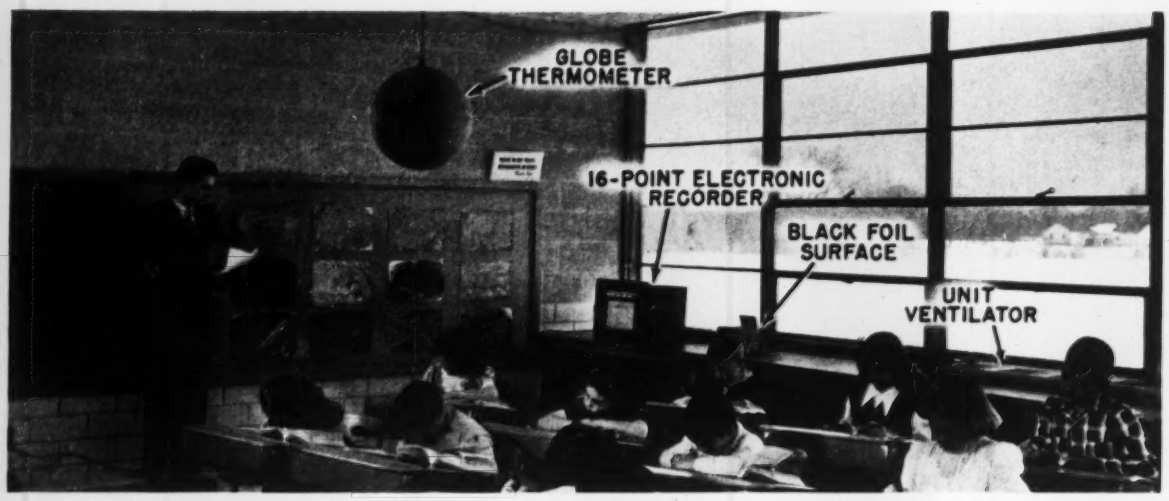
Measuring the Solar Radiation

A black foil surface was used to measure solar load; it was mounted in position looking through the classroom window from outside. A loose thermocouple was used to measure ambient air temperature immediately in front of the foil surface. The black surface itself consisted of two sheets of thin aluminum foil between which was sandwiched a thermocouple, all mounted on a piece of ½ in. thick fiber insulating board.

In theory, if the black foil surface temperature is greater than the ambient air, a net radiant gain between the foil and inside window glass surface exists, usually because of external solar gain through the windows. At night, the black foil surface temperature is consistently below ambient air temperature since radiant loss to the colder window glass is not offset by solar gain.

The black foil surface proved to be an excellent direct solar load recorder, since it was not sensitive enough to go over 150 deg or off the potentiometer recorder scale when exposed to direct sunshine, yet was sensitive enough to show considerably lower readings whenever clouds covered the sun.

However, the surface gives no quantitive reading of solar gain other than that obtained by comparing one chart with another. Conceivably, this foil surface could be calibrated for a given ambient air temperature by noting surface temperatures attained with known amounts of heat radiation. However, for the purpose of this study the surface as used was sufficient and no calibration attempt was made.



A GLOBE THERMOMETER in the east exposure research classroom evaluated overall room radiant conditions. Educators as well as the research men were pleased that the children respected the instruments, did not damage them

Globe Thermometer Evaluates Overall Room Conditions

A globe thermometer was used to evaluate overall room radiant conditions.

The globe thermometer was developed in England by H. M. Vernon in 1932 in an effort to provide a simple means for estimating mean radiant temperature at any point within an enclosed space, providing the temperature and velocity of the air contacting the globe surface is known. It consists of a hollow metal sphere, usually 6 in. in diameter, with a mercury thermometer positioned within the globe and the bulb at its center and the stem projecting out the top. Differences between the readings of the thermometer within the globe and the true ambient air temperature outside it, appropriately weighted to allow for the increased convective heating or cooling effect due to adjacent air movement, give an index of the radiation gain or loss of the instrument and therefore of the mean radiant temperature of the surroundings.

The globe thermometer was developed as a means for isolating the factor of mean radiant temperature from other factors in the thermal environment. However, it has a simpler and more direct value in measuring what is called the "black body resultant temperature." This is merely the temperature which the globe assumes when subject to a given combination of air temperature, radiant temperature and air movement. Since the skin and clothing react to these factors in approximately the same way as a 6 in. globe, because of surface area to volume proportions, the black body resultant temperature is a better index of comfort conditions than temperature of the air alone. (The globe readings do not provide an adequate index of comfort conditions at other than minimal rates of air movement, but this is even more true of the ordinary thermometer.)

In designing and building the globe thermometer used in these studies, an effort was made to improve on Vernon's model by using thermocouples rather than thermometers to measure inside and outside globe air temperatures. This made it possible to obtain instantaneous temperature readings without the characteristic lag of a bulb thermometer, and also enabled printing of the readings continuously on the potentiometer chart without need for visual observation. In order to improve accuracy in reading the charts, since normal temperature difference is usually less than 1 or 2 F, the inside globe thermocouple was connected to 19 other thermocouples in series, alternately placed inside and outside the globe. This created a temperature difference multiplier of nine and simplified chart reading greatly.

The four 6 in. globes used were each spun in hemispherical sections out of No. 26 ga sheet aluminum. These hemispheres were later joined, after the inside thermocouples had been mounted. The exterior surface was painted a matte sahara tan, rather than black in accordance with the usual practice, so as to have somewhat the same absorptivity to short wave length solar radiation as do skin and clothing. (This does not prevent the globes from showing the "black body resultant temperature," since this term is used in the sense of low temperature, long wave length radiation, which is absorbed about equally by most types of paint regardless of color.)

Radiation Thermopile Reads Surface Temperatures

A directional radiation thermopile connected to a recording and indicating potentiometer was also used. This thermopile contains 20 each hot and cold thermocouple junctions. The "hot" junctions are blackened to readily absorb radiant heat energy. A radiant heat energy collecting and concentrating means is provided in the shape of a cylindro-parabolic reflector 6.375 in. deep, in the line focus of which the blackened row of junctions is fixed. The collecting aperture of the horn is 6.5 cm square; heat rays entering the collector over this entire area are so concentrated that the net intensification, with losses for absorption deducted, is about 20 times.

By decreasing this net intensification of the thermopile it is possible to calibrate the instrument to read

surface temperatures of whatever surface the thermopile is pointed at; for example, the directional thermopile pointed at an interior wall surface of 72 F, reads 72 F on the indicating potentiometer. Likewise, when pointed at a cake of melting ice, it reads approximately 32 F. This calibration was accomplished by a gradual cut-and-try process in determining the correct face area in the slotted shield in the thermopile aperture. The instrument was then mounted on a tripod, pointed at the inside window surface and used to measure the apparent inside window surface temperature.

At night the directional thermopile temperature reading of the inside glass surface temperature coincided, as would be expected, with the reading of the cemented thermocouple mentioned earlier. However, during the daylight hours thermopile readings were consistently higher than its thermocouple counterparts due to radiant energy called "sky-shine" or sky radiation which enters through the windows and is measured by the thermopile.

School Kids Respect the Instruments

An interesting sidelight to this heating and ventilating research program — and a point of extreme interest to the teachers and educators involved — was the fact that the delicate and expensive instruments could be left within the classrooms unattended for days at a time without interference from the children.

Extreme care was taken by the research personnel to explain the instruments and their functions to the children in elementary school language at the beginning of each research phase. This seemed to kindle the children's interest in the research, and at the same time developed their respect for the instrumentation involved.

[Two of the other talks given at the symposium were summarized in the March HPAC, and the others will be reviewed later.]

HENDERSON LEAVES ACRMA, JOINS DMAA

A. O. Vogel, president of the Air Conditioning & Refrigerating Machinery Association, announced last month the resignation of William B. Henderson, who was executive vice president of ACRMA for almost 19 years. He left to join the Direct Mail Advertising Association.

ACRMA is presently without a replacement, but the secretary, Miss Mary Jane Stewart, is carrying on, as she did during the war years.

Association activities are continuing as they have in the past, but plans are on foot for an expansion of these activities, according to Mr. Vogel.

OVERHEATING CAUSES "HEAT RASH," WASTES FUEL

Many of America's millions of apartment dwellers are living in quarters so overheated that some have broken out with heat rash in the middle of winter.

"In a large new apartment building in Boston," a heating expert recently told members of the Milwaukee board of realtors, "we found average temperatures in the vicinity of 85 deg or higher. In talking with tenants, we actually discovered people with heat rash — that's in the wintertime.

"And in a very recent series of tests in another city — although this was hard for us to believe — we found an apartment building with temperatures averaging 86 deg over a 24 hour period and soaring to 90 deg plus at times."

Will T. Gove, of Minneapolis-Honeywell Regulator Co., said research studies by the firm's engineers disclosed that there is "almost universal gross overheating" in apartment buildings and the amount in the average building is "astounding." It causes not only mass discomfort, he added, but also a "staggering loss in fuel dollars." He estimated the lack of adequate or proper controls alone was costing $100 million annually in wasted fuel.

Growing realization of this waste, Mr. Gove said, accounts for "a strong trend" toward individual apartment temperature control.

HIGHLY OPTIMISTIC ON CONSTRUCTION'S FUTURE

Far from being apprehensive of the effects of any possible cut in defense spending, a panel of distinguished authorities at the San Francisco convention of the American Society of Civil Engineers last month took a highly optimistic view of the construction future.

"Defense construction spending is relatively a small portion of total security spending, so that if this construction spending does essentially stop, it does not have a marked effect on the total economy," said John P. Yates, senior vice president, Bechtel Corp.

"From the long range aspect there are two important factors favoring a high level of construction activity. First is the tremendous increase in population now being experienced. Schools, homes, community and commercial buildings, utilities and highways all must expand. Even more important will be additional production facilities to supply food and consumer goods.

"The second factor has to do with consumption of our basic natural resources. The President's materials policy commission finds not so much a shortage of resources, but an increase in demand, and a steady increase in the cost of materials. There follows a demand for technological developments, for more efficient extraction of materials — and the use of substitutes for those materials in shortest supply.

"When defense restrictions on critical materials and manpower can be released, retarded programs for schools, streets, highways, institutions and other public works can well accelerate to a point where correcting these deficiencies could alone offset much of the drop in defense construction."

HEAT PUMP SERVES BILL'S DINER

A 5 hp heat pump is providing the heating and cooling in "Bill's Diner", North Canton, Ohio. With the cooking also done by electricity, the glistening, modern establishment is believed to be America's first all-electric diner, according to the General Electric Co.

The air-to-air unit is located in a small, out-of-the-way service corner of the diner. Short duct runs bring the cool or warm air into the diner proper.

Recent Developments in Resin-Wool Air Cleaners

By Howard C. Murphy
Consulting Engineer

I ATTENDED THE Fourth International Mechanical Engineering Congress in Stockholm, Sweden, last summer and also spent several months investigating air purification procedures in various parts of Europe.

I had the opportunity of inspecting a number of air cleaner installations and was also fortunate in being able to visit several government or industry-sponsored laboratories where research and development work on air cleaners was in progress. It was my impression that a great deal of attention is being given abroad to the development of air cleaners designed to eliminate fine particles (below two microns).

The resin-wool "electrostatic" air filter developed in Denmark — and in England, Italy and the United States — is in rather large-scale commercial production in England. Up to the present, however, it has been used almost entirely for government projects, where the removal of very fine air impurities is important. The filter has not come into general use for ventilation and air conditioning work, an application for which it seems well suited. The production of this filter has been considerably simplified, and some of the operating difficulties experienced with earlier types have been largely overcome. There is also a more complete understanding of the principle on which the filter operates.

The resin-wool filter consists of wool fibers, coated or impregnated with certain types of resin or plastics. The resins receive a negative electrostatic charge through a carding operation during the manufacturing process. This charge not only acts as a collecting agent to remove very small impurities from the air stream, but also aids in maintaining intimate contact between the resin and the wool fiber. The negative charge on the particles of resin induces a positive charge of equal value on the wool fibers. The filter as a whole is therefore a neutral system.

Much of the effectiveness of the filter is due to the selection of suitable resins or plastics. These materials should have a volume resistivity of at least 10^{19} ohm cm. The melting point is also a factor, as the residual conductivity appears to depend on the mobility of the ions and could be influenced by the hardness or melting point of the material. If the resin is treated to develop an oil repellent action, effective life of the filter is extended.

A properly designed resin-wool filter can have (I understand) an efficiency in excess of 99 percent by the methylene-blue method against particle sizes of one-half micron when handling 14 fpm at a resistance of 0.3 W.G.

Shelf Life of About 10 Years

The filter has a shelf life of approximately 10 years under normal storage conditions. In use, however, it becomes progressively less efficient as an electrostatic air cleaner due to the passage of air through the filter and the collection of dust on the media. After losing approximately one-half of its initial efficiency as an electrostatic cleaner, it begins to increase in efficiency and resistance to air flow as a mechanical air cleaner, for the free area of the media is decreased due to the collected dust.

The depth of the filter bed should be considerably greater than with filters designed primarily to remove relatively large particles (larger than five microns) as the impingement or inertia effect of particles smaller than this size is negligible.

The mechanical collection of these smaller particles is due not to inertia but to diffusion or Brownian motion. The path of air travel through the filter should therefore be longer and the gas should travel at a lower velocity in order to secure maximum contact with the filter media.

A loss of electric charge is accelerated by exposure to high temperatures, ionizing radiation and oil mists or "smogs"; deterioration from oil mists can be lessened to some extent by the use of oil repellents with the resin coatings.

While the resin-wool filter has a number of advantages for the removal of many types of submicron particles from an air stream, it apparently is not acceptable for use against radioactive impurities. It would require approximately one million Roentgens of external radiation to break down the charge on this filter, but an extremely small amount of radioactive material collected on the media itself would be sufficient to discharge it.

Use Smaller Quantities of Air

For this reason a filter of the "absolute" type is usually preferred by European engineers for this work. These engineers use much smaller quantities of air than is customary in the United States, thus reducing the size and cost of the air handling and air purification equipment.

There appears to be no additional health hazard in cutting down the amount of air supplied. As pointed out in my article on Ventilation of Survival Areas for Civil Defense, in the May 1951 issue of HPAC, I feel that by using larger quantities of air than is absolutely necessary, we make this phase of civilian defense unnecessarily expensive.

Mr. Murphy, who is a member of HPAC's board of consulting and contributing editors, has had wide experience in air filtering and cleaning, and in recent years has been quite active in civil defense problems.

How Warm a Ceiling?

What's the relationship between comfort and heated ceilings? These carefully planned studies recently made in England assess the risk of producing unpleasant conditions

A Review by Cyril Tasker

ABOUT A YEAR AND a half ago, it was learned that the staff of the Environmental Hygiene Research Unit of the Medical Research Council, London, England, was conducting a carefully planned series of experiments in the heating laboratory of the Building Research Station to obtain an assessment of the risk of producing unpleasant conditions in rooms with heated ceilings.

Since the outcome of these studies has been awaited with some eagerness, the paper published in the January 1953 issue (Vol. 20, No. 209) of the Journal of the Institution of Heating and Ventilating Engineers, under the authorship of F. A. Chrenko, is certainly an important one. It is one of the first to be published on a subject that is becoming of increasing interest. Dr. Thomas Bedford — well known to many on this continent — is Director of the Environmental Hygiene Research Unit.

"Everyday experience shows", the report begins, "that exposure of the head to excessive warmth may lead to discomfort, and it is known that a heated ceiling may produce unpleasant conditions. Hitherto, however, there has been insufficient experimental evidence to make a quantitative assessment of this risk".

How Index of Discomfort Was Established

The author defines the threshold value of a stimulus, or change in environmental conditions, as the minimal value that will cause a person to react in a particular way and points out that it is not the same for different persons. He defines the *mean* value of the thresholds for a large number of persons as that which will produce the given reaction in 50 percent of the group.

While the minimal value of a radiative stimulus required to cause a person to experience discomfort could be used to ascertain the maximum desirable ceiling temperature for that person, he suggests that the mean threshold for a group of persons should *not* be used for design purposes.

"If many persons are exposed to a given radiative stimulus", he says, "some may experience discomfort while others may not. When the intensity of the stimulus is increased, the proportion of persons who experience discomfort will also increase. Therefore, if groups of persons are exposed to stimuli of increasing intensities of radiation, a relationship may be established between the proportions of subjects who experience discomfort and the intensity of the stimulus. From this relationship it is possible to assess quantitatively the risk of producing discomfort with a known stimulus, and thereby calculate *the maximum desirable temperatures of the surfaces of panels of various sizes embedded in ceilings of different heights.*"

The Experimental Room and Panels

The test room of the heating laboratory at the Building Research Station is about 12 ft x 18 ft in plan, with a ceiling that can be adjusted in height from 8 ft. 6 in. to 11 ft. 6 in. The temperatures of the walls, floor and ceiling can be separately controlled; the temperature of the air in the room and the rate of ventilation can be controlled but the relative humidity cannot.

In the first series of tests, an electrically heated experimental panel, 6 ft by 4 ft, was used as the main heating element. It could be raised or lowered as desired and had a maximum heating load of 2 kw with a maximum surface temperature of 160 F.

In addition, and for use in later tests, electric wallpaper was laid in strips on the ceiling of the room to cover about 80 percent of its total area, thus giving an electrically heated ceiling panel of about 11 ft x 16 ft, with a maximum load of about 16 watts per sq ft and a maximum surface temperature of 120 F.

Experiments Divided Into Three Phases

The experimental work was divided into three phases.

First, a group of five staff members of the research unit, (four men and one woman, and referred to in the report as group A) were exposed to radiation from (a) the 4 ft x 6 ft heated panel and (b) the 11 ft x 16 ft heated ceiling, at different temperatures and different heights.

Second, a group of 152 members of the staff of the Building Research Station (114 men and 38 women, and referred to as group B) were exposed to radiation from the heated ceiling at different temperatures but at one height, 8 ft. 6 in. In both these series the walls, floor and unheated portions of the ceiling were maintained at a uniform temperature.

Third, three members of group A formed a third group, C, for studies designed to see what effects a cold

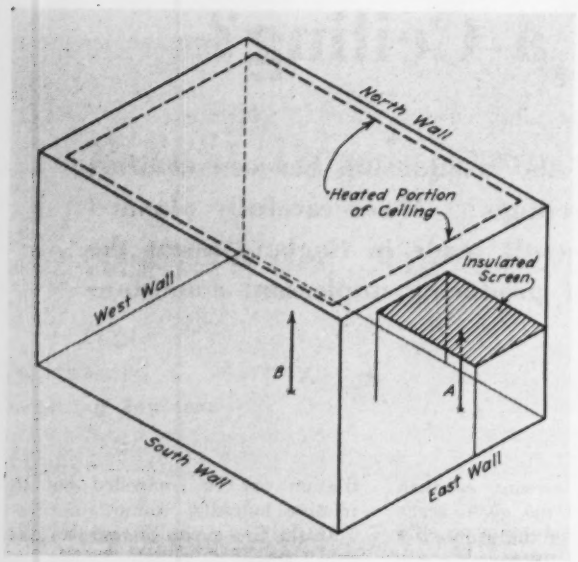


FIG. 1—COMFORT STUDIES WERE MADE in the heating laboratory of the Building Research Station in England. This isometric sketch was prepared especially for this review article. Arrow at "A" represents seated subject before exposure to radiation from ceiling. Arrow at "B" represents seated subject in middle of room fully exposed to radiation from ceiling. Subject faced the west wall

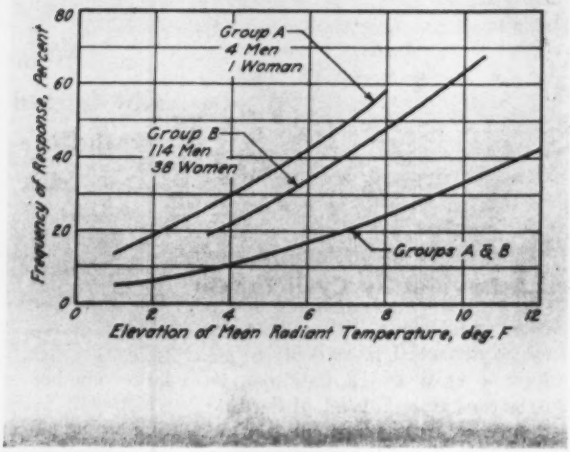


FIG. 2—ELEVATION OF MEAN RADIANT TEMPERATURE (MRT) and frequency of response that the environment was unpleasant. Group A was exposed to heated panel and Group B to heated ceiling. Lower curve shows frequency with which uncomfortable warming of the head was experienced for groups A and B exposed to heated ceiling

wall had on sensory reactions to radiation from a heated ceiling.

Radiation Calculations, Environmental Measurements

The mean radiant temperature (MRT) was determined both by direct measurement with a thermopile, and by calculations based on the temperatures of the boundary surfaces of the room and the solid angles which they subtended at a point at the position of the head of the subject. Since direct measurements and the calculated values agreed within 0.5 F, and since it was much simpler to calculate the MRT than to measure it, calculated values were used in all the tests with groups A and B.

"At ordinary room temperatures," the author points out, "an increase of 1 F in the MRT corresponded almost exactly to an increase of 1 Btu per sq ft per hr in radiation intensity."

In these studies the internal surfaces of the test room were assumed to have emissivities practically equal to that of a black body. Since it has been shown that both the skin and clothing of a man behave thermally as a black body, surface emissivity was not considered as a factor affecting the radiation calculations. Neither the shape of the body nor the orientation of the body toward the radiating surface was taken into account in this work (as Professors Raber and Hutchinson did in their studies.)

The mean rate of ventilation was equal to two air changes per hour, "sufficient", Mr. Chrenko says, "to prevent body odors from affecting subjective impressions of freshness". Air movement did not exceed 20 fpm throughout the experiments.

Sensations of Warmth, Freshness, Unpleasantness

During an exposure limited to 30 minutes, the subjects were questioned concerning their sensations of warmth and impressions of freshness, on the basis of the scales of Bedford and Warner (1939). The warmth scale used was:

Sensation	Numerical mark assigned
Much too warm	+3
Too warm	+2
Comfortably warm	+1
Comfortable	0
Comfortably cool	−1
Too cool	−2
Much too cool	−3

The subjects were also questioned concerning their sensations of warmth with reference to the head, the feet and the rest of the body, were asked to assess their overall impressions of warmth, and were also asked whether the environment was unpleasant or not.

EXPERIMENTAL RESULTS

Table 1 gives pertinent data on the environmental conditions under which the tests were made. All the

TABLE 1 — THE MEAN VALUES of the environmental factors

Subject group	Experiments with heated panel: Dry bulb air temp., F	"Unheated" mean radiant temp., F	Relative humidity, percent	Experiments with heated ceiling: Dry bulb air temp., F	"Unheated" mean radiant temp., F	Relative humidity, percent
A (5 persons)	66.2	65.6	52	66.9	66.7	60
B (152 persons)	—	—	—	67.3	63.7	55
C (3 persons)	65.2	66.5*	47	—	—	—

*Temperature of the north wall of the test room: 54.7 F.
Temperature of the windows (internal surfaces): 48.8 F.

tests indicated, the author states, that the percentage frequency of discomfort was more closely associated with the *elevation of MRT at head level* due to the overhead radiation, than with the *intensity* of the radiation received either by the forehead or the top of the head.

Discomfort Due To Radiation

In considering the results, it is important to understand how the value for "elevation of MRT" was arrived at. First, the MRT was determined at head level in that part of the test room where the subject sat before being exposed to the radiation overhead. Second, the MRT was determined at head level in the part of the room where the subject was exposed to the radiation overhead. The difference between these two values gave the "elevation of MRT at head level due to overhead radiation". "The resulting value", the author says, "represents the thermal stimulus, or change in the environment to which the subjects were exposed, since all other environmental factors remained constant for a given experiment."

Fig. 1 — which was not included in the paper published in the IHVE Journal but was supplied later by Mr. Chrenko for use in this review — illustrates the method used to determine the MRT at head level with or without exposure to overhead radiation. Under the insulated screen the head of the subject at "A" is "seen" (from a radiation standpoint) by the walls and floor but not by the ceiling. At "B", the head of the subject is "seen" by the walls and the floor as well as by the ceiling.

Results with the five subjects of group A, exposed to the 6 ft x 4 ft heated panel, and with the 152 subjects of group B, exposed to the heated ceiling at the 8 ft, 6 in. height, are shown in Fig. 2 — which has been redrawn from two separate figures in the original paper. These curves show the percentage frequency of the response of the subjects — that is, when they voted that the environment was unpleasant — plotted against the increase of MRT in degrees Fahrenheit at head level due to heat from the panel or from the ceiling. The curves were derived from the results of statistical methods of analysis applied to the subjective data.

Also shown in Fig. 2 as the lower curve is a plot of the relationship between the frequency of occurrence of an uncomfortably warm head (+2 or more on the scale of warmth) and the elevation in MRT. From a comparison of the lower curve and the two other curves it can be seen that, for a given increase in MRT at head level, the percentage incidence of sensations summed up as "unpleasant" was *higher* than the incidence of uncomfortable warming of the head. Since this indicated that discomfort could be caused without perceptible overheating of the head, the various symptoms associated with unpleasantness were analyzed by asking the subjects to give reasons for making their decisions. The various symptoms were then divided into six different classes, the results being shown in Table 2, in which the frequency of occurrence of symptoms in each of these classes is expressed as a percentage of the total number of symptoms reported by the subjects.

The author suggests that these results provide a possible explanation of the occurrence of unpleasantness when a subject's head is exposed to radiant heat even though the head, as a whole, is not uncomfortably warm. "The tests showed", he says, "that when the head was too warm the incidence of discomfort was nearly 100 percent, regardless of the warmth of the feet, but even when the head was not uncomfortably warm, unpleasant sensations were evoked and their frequency of occurrence increased as the feet were cooled."

Attention was paid during these studies to the "freshness" — or the opposite, the "stuffiness" — of the environment, an eight-point scale being used to cover the range "very stagnant" to "very fresh." The tests with group B indicated that the head must become much too warm before the onset of definite stuffiness.

Effects of Cold Wall on Comfort

The conditions under which the tests with a cold wall were made are given in Table 1 for group C. Two subjects were in the room — one was seated about 3 ft from one of the windows and was exposed to radiation from a heated ceiling; the other sat about 3 ft from the other window but was shielded from overhead radiation.

It was found that exposure to the cold wall, without radiation from the heated panel, caused no unpleasant sensations. Although it did appear that, with a cold wall, the discomfort associated with overhead radiation was increased, the effects were not sufficient to justify lowering the maximum desirable ceiling temperatures established for more uniform environmental conditions and discussed later. (Table 3).

Significance of Results in Designing Systems

Mr. Chrenko points out that, in practice, difficulty may be encountered in assuring that no discomfort will arise from ceiling heating no matter what the environmental conditions are. And yet, he says, the system should be designed and operated to avoid any considerable risk of discomfort. In Dr. Bedford's work, the "comfort zone" was that in which not less than 70 percent of the subjects were comfortable, and in fact 86 percent of the votes ranged from comfortably cool to comfortably warm.

"In designing ceiling heating", Mr. Chrenko says, "to keep the incidence of discomfort down to as low a level as possible, the elevation of the MRT

TABLE 2—PERCENTAGE FREQUENCY of occurrence of symptoms associated with feelings of unpleasantness among the subjects of Groups A, B and C

Symptoms associated with unpleasantness	Frequency of occurrence of each symptom associated with unpleasantness, expressed as percentages		
	Group A	Group B	Group C
1. Warmth on the head	40	41	58
2. Effects on the eyes	31	5	10
3. Other effects on the head apart from (1) and (2)	10	19	24
*4. Gradients of sensation	9	24	19
5. Stuffiness	7	5	3
6. General thermal discomfort	3	6	6
Total (per cent)	100	100	100

*Symptoms associated with differences between localized sensations of warmth of the head and the feet, i.e., warmth of the head while the feet were chilly.

at head level should not exceed 4 F, or the increase in radiation intensity at a point at head level should not exceed 4 Btu per sq ft per hr. These round figures represent the level of thermal stimulation of the head associated with about 20 percent frequency of occurrence of unpleasantness. This criterion is associated with about a 10 percent risk of uncomfortable warming (but not gross overheating) of the heads of the subjects."

Maximum Desirable Ceiling Temperatures

The paper, as published in the IHVE Journal, contains a number of tables giving the maximum desirable temperatures of ceiling panels in relation to the size of the panel and the height of the ceiling. Table 3, presented here, has been developed from these more extensive data. In studying the recommended values it should be borne in mind that they are developed on the following assumptions: (1) only one panel in the ceiling, (2) the subject is seated beneath the center of the panel and (3) the MRT, in the absence of ceiling heating, is 65 F.

Recommendations and Practice Compared

In Britain

H. H. Bruce [Year Book of the Heating and Ventilating Industry, 1950. Technitrade Journals, Ltd., London.] of the Panel Warming Association (London) says that there are many installations in offices in Britain where the ceilings are 9 ft and 10 ft high, where the panels are installed in units of about 60 sq ft and operate at maximum surface temperatures of 105 F without giving any discomfort due to excessive radiation at head level. He has also said that while the introduction of ceiling heating into buildings with low ceilings and small rooms may appear to be hazardous, panels can be arranged in such a manner that there need be no fear of excessive radiation at head level. To insure this, not only the panel area but the panel dimensions must be specified, because of the influence of the panel dimensions on the solid angle subtended by the panel at the head of the occupant.

Although Mr. Chrenko gives some tabular data to show the relationship between the maximum desirable surface temperature for ceiling panels and the position of the occupant when he is seated at other locations than beneath the center of the panel, he suggests that design criteria should be based on the conditions when the occupant of a room *is* beneath the center of a panel in the ceiling.

In America

The panel surface temperatures recommended for different panel sizes and ceiling heights appear to be low, Mr. Chrenko says, when compared with some American figures. He quotes from the book, Radiant Heating, by R. W. Shoemaker, in which the following surface temperatures are given: 102 F for an 8 ft ceiling; 107 F for an 8 ft. 6 in. ceiling; 113 F for a 9 ft ceiling; and 125 F for a 10 ft ceiling. While the area of the heated surface in the ceiling is not specified, Mr. Chrenko says, two-thirds of those taking part in the British experiments would have experienced unpleasantness if a ceiling 8 ft. 6 in. high and of dimensions 11 ft x 16 ft had been maintained at 107 F.

He also quotes T. Napier Adlam (1947) who gave a temperature of 99 F for a room 18 ft x 16 ft with a ceiling height of 12 ft under outdoor conditions of 0 F. Mr. Chrenko says that two-thirds of the subjects taking part in his tests would be satisfied with Adlam's conditions.

He concludes his discussion of this point as follows: "It would appear that a ceiling temperature of 105 F is unnecessarily high for smaller rooms with lower ceilings in the milder British climate when the external temperature is taken for conventional design purposes as 30 F, especially if the whole of the ceiling is heated."

Causes of Unpleasant Sensations

The majority of unpleasant symptoms were referred to the head. In these studies, Mr. Chrenko says, "vertical gradients of air temperature were absent, but since the MRT at head level was higher than at floor level vertical gradients of radiant temperature were present. It was found that when the MRT at head level was 5 F higher than the MRT at floor level, the frequency of occurrence of uncomfortable warming (but not gross overheating) of the head was 50 percent.

"It has been stated in the literature," he says, "that the temperature of the air at head level should not be more than 5 F higher than the temperature at floor level. Our results appear to confirm this, since in still air (less than 20 fpm) the MRT and the air temperature have about equal effect on the overall level of warmth."

Discussing the effect of chilling of the feet, Mr. Chrenko quotes experiences which, he suggests, may be of interest in connection with the installation of ceiling heating in hospital wards. "It is reasonable to assume", he says, "that the feet of patients in bed will be comfortably warm. Chilling of the feet of the hospital staff is not likely to occur in a multi-story building, since the heated ceiling of one ward will warm the floor of the ward above. Therefore, it may be possible to heat the ceilings of hospital wards to temperatures which may be higher than those which might be advisable in the first floor living rooms of dwellings with low ceilings.

"This does not appear to be necessary if the conditions recently found in a modern hospital are typical. The dimensions of the ward investi-

[*Concluded on page* 114]

TABLE 3 — MAXIMUM DESIRABLE temperatures of ceiling heating panels

Panel dimensions, ft	Maximum desirable temperatures (F) of panels of various dimensions when the height of the ceiling is: 8 ft	9 ft	10 ft	12 ft
48 sq ft				
2 x 24	112	124*	135*	138*
4 x 12	98	104	113	135*
8 x 6	92	100	109	130*
54 sq ft				
3 x 18	100	109	119	137*
6 x 9	87	93	107	120
96 sq ft				
4 x 24	92	97	104	119
8 x 12	82	86	91	103

*Note that the ASHVE Guide says (page 543, 1952 edition): "Generally, the surface temperature of plaster panels should not exceed 120 F."

THE LAW AND YOUR PROFITS

Options, Restrictive Clauses Should Be Watched With Care

FOR ONE WISHING to sell a business — or for one about to purchase a business — the following case deserves thoughtful reading. Particularly is this true because it deals with oft-occurring "money-traps" — namely options — as well as with restrictions on the seller continuing in a similar line.

Allgood Heatter optioned his piping business to Heza Tuba (all the names herein are imaginary) and collected $1000 in consideration therefor. This was on November 10, and another $1000 was to be paid on November 24 as an installment on the purchase. Further installments were payable each month thereafter.

Tuba did not make the November 24 payment, but took possession of the business, trucks and inventory. On January 5, Tuba borrowed $1000 at the bank, with Heatter's indorsement, and paid that sum to Heatter on the option-agreement-to-purchase — thus taking care of the November 24 payment but nothing further. Subsequently, Tuba repaid the bank at no cost to Heatter.

Near the end of January (still without further payments) Heatter got nervous and demanded the return of what he had sold. Accordingly, on the 27th of that month the parties entered into a second agreement, which provided that Tuba should "without delay return" to Heatter the inventory and motor vehicles "so far as such inventory may have passed" to Tuba. In addition, Tuba further agreed to furnish Heatter with "sufficient materials and supplies to equal 87 percent of $1000 computed at cost price." This $870 contribution from Tuba's own supplies, together with his previous cash payments, put him $2870 in a hole on the transaction — with presumably nothing to show for it.

That hole contained an ace, however. At the bottom of the second agreement, above the signatures but below the dating and perhaps as an afterthought on Tuba's part, appeared the following restrictive clause:

Heatter "shall not work in said business for a period of five years within" the subject town's "area except with approval" of Tuba "and except for such contracts" let by a certain named builder as Tuba might be "unable" to handle.

Heatter Appeals to State's Supreme Court

Despite this restrictive clause, Heatter went back to work in the piping business within the prohibited area. Tuba promptly obtained a superior court injunction restraining Heatter from so doing and compelling him to obey the clause. Heatter appealed to the state's supreme court, brought forward six arguments:

1) There was no necessity for an injunction, since Tuba failed to show that he suffered any damages. On this point, the higher court held, as in previous cases, that a restrictive covenant is enforceable even though no damages have been shown. "It is not necessary that the buyer first prove special pecuniary damages or show an actual loss of customers who might in any event have discontinued their patronage," said the court.

2) To the plea that Tuba did not suffer special damages of any kind, the court's retort was similar to that above.

3) Heatter claimed that the wording of the agreements was "so vague and ambiguous" as to be "void"; but the judge followed a cited legal principle carrying into effect "the reasonable intention of the parties . . . The exact meaning" of an agreement, ruled the court, "may be determined by . . . extrinsic facts relevant to the question."

4) There was no consideration for the restrictive clause, urged Heatter. His point was that since Tuba failed to make the $1000 payment for exercise of the option on November 24, he lost the $1000 already paid *for* the option, as liquidated damages; furthermore, that Tuba "was duty bound to return the vehicles and inventory." In this connection, the court — noting that the business was not turned over to the purchaser by the seller until the purchaser had already defaulted in exercising the option — asked Mr. Heatter at the hearing:

"On the 24th of November" did Mr. Tuba "exercise the option to buy the business?"

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"I let him take it over," Heatter replied, "but he did not pay the $1000."

"Ah, then", opined the court in effect, "by turning over the business without the payment," Mr. Heatter "waived the breach" by Mr. Tuba and could not hold it against him. "Even without this, the same would hold true, as on January 5" Heatter "accepted $1000 which was given as a payment on the business. By reason of this payment, there was no longer only an unexercised option, but rather this payment was in effect the $1000 which was supposed to be paid on November 24 to exercise the option." Though Tuba's January 5 payment thus made him "liable for the full performance of the contract", nevertheless "as evidenced by the writing of January 27, the parties changed their minds as to what should constitute" such full performance.

In consequence, this later writing, as reviewed by the court, stipulated that upon re-transfer of the properties Tuba "shall be relieved now and forever from . . . any further payments under . . . contract of November 10 . . . and said agreement shall be considered executed in full" by Tuba "in every particular." There was an additional consideration of $870 worth of supplies turned over to Heatter.

5) Heatter urged that the permanent injunction should not have been issued, because the restrictive clause prohibiting him from earning a livelihood was against public policy. The supreme court held that, because the restriction was limited as to area and did not prohibit Heatter from engaging in other kinds of work, but rather from working in "said business," the clause was "reasonable" and did not violate public policy.

6) Finally, Heatter attacked the injunction itself as "vague" and "ambiguous". The supreme court thought otherwise. In common with the superior court, the higher tribunal construed the restrictive clause as meaning that Heatter should not be *associated* with the piping business, either as operative or contractor.

Having thus repelled all six of Heatter's arguments, the supreme court denied his appeal and let the injunction stand.

Court's Ruling Has Several Lessons

The ruling on the above arguments carries cogent lessons for all those who would option, sell or purchase a heating, piping or air conditioning business.

Restrictive clauses — such as those restraining one party's business activity — must be carefully watched, because such clauses are *enforceable* even if the other party is *not damaged*.

Reasonable *intention* of all parties governs *any* agreement, and its exact meaning depends upon *outside facts*.

If a property is optioned and then turned over to the purchaser *after* he has *defaulted* in exercising his option, the seller *waives* the breach and cannot hold it against him.

Restriction against a party's engaging in a certain business is not necessarily against public policy; and language restricting him from "working in" such business generally means that he must not become "*associated*" with such business in any capacity.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

HOW WARM A CEILING? —

[*Concluded from page* 112]

gated were 73 ft by 27 ft by 12 ft. The two long walls were external and unheated, while the ceiling was heated directly by two large panels, each with dimensions approximately 70 ft by 7 ft. The mean temperatures of the heated and unheated portions of the ceiling were, respectively, 82 F and 67 F. The heat from the ceiling was sufficient to maintain, at a distance of 5 ft from the floor, a mean dry bulb air temperature of 68 F and an MRT of 72 F inside the ward when the temperature of the air outside varied between 35 F and 45 F. The floor of the ward was warmed by the panels embedded in the ceiling of the ward below, and the mean air temperature and radiant temperature at a distance of 9 in. from the floor were, respectively, 68.2 F and 72 F. Thus there were no vertical gradients of air or radiant temperature."

Although his paper is not directly concerned with floor heating, Mr. Chrenko suggests "that it is noteworthy that the mean temperature of the surface of the floor in the region heated by the panels in the ceiling of the ward below was 78 F. The patients were unaware of any heat reaching them from the ceiling, but they knew that the floor was heated and they found that conditions were satisfactory. Members of the nursing staff, however, found the warm floor very trying to the feet, especially at the beginning of the heating season."

Discussion, Comment Are Invited

The results given in this timely and interesting paper will, it is hoped, be of interest to many of those engaged in the design, installation and operation of ceiling panel heating systems in America. The Institution of Heating and Ventilating Engineers invites discussion of this paper. Letters should be addressed to the Secretary, Mr. H. Swain, at 75 Eaton Pl., London, S.W. 1, England, to whom the writer's thanks are due for permission to quote extensively from the paper as published. Thanks are also due to Mr. Chrenko for permission to use Fig. 1, which was specially prepared for this article.

BIGGEST YEAR FOR AIR CONDITIONING SALES

COMMENTING ON 1952 results and the future outlook, Cloud Wampler, president of Carrier Corp., pointed out that last year was the biggest with respect to sales volume in all air conditioning history — both for Carrier and the industry as a whole — in spite of numerous restrictions on construction and usage of materials. Then he added:

"Assuming no great change in general business conditions, Carrier's upward sales trend should be maintained and perhaps even accelerated during 1953. However, profits are not apt to increase proportionately because of rising production costs, increased competition and lower margins on defense business."

In connection with a news story emanating from Chicago, Mr. Wampler recently denied reports that negotiations are under way regarding a merger with Willys-Overland.

DATA SHEET

How To Size and Install Condensate Return Lines

• *The following data was published in the Armstrong Trap Magazine — issued by the Armstrong Machine Works — under the byline of R. E. McPherson, consulting engineer. The table is based on experience. Other engineering experience which can be incorporated to improve or substantiate the accuracy of the recommendations will be welcomed.*

SIZING OF CONDENSATE return lines presents problems different from those encountered in the sizing of steam or water lines. Here is why:

1) A return line has to handle both water and flash steam.

2) The volume of flash steam does not remain constant in the return line. The tendency for flash to expand as it travels away from the trap to areas of lower pressure is more or less offset by condensation of flash due to radiation losses from the return lines.

3) Condensate return lines may be exposed to corrosive or dirty condensate causing a build-up of scale to reduce the size of the pipe or pitting to increase friction.

These factors have been taken into consideration by engineers in developing condensate return line sizing tables based on successful experience. An analysis of these tables shows that the recommended return header sizes provide:

1) Conservative condensate velocities.

2) Low pressure drop compared with the pressure drop in the discharge line from a steam trap to the header.

Pipe Size Table

The table on the next page (lb per hr condensate capacities of gravity, vacuum and pressure returns) is a composite of tables in everyday use. Pipe sizes recommended in this table provide pressure drops and condensate velocities within the range of generally accepted practice.

Condensate Velocities

The condensate velocities in feet per second shown in the table are those occurring in lines carrying the full condensate loads listed in the table. If loads are lighter, velocities will be less. Note that velocities are lower at lower steam supply pressures. This is due to the lower head (last line of table).

Note also that at any given steam supply pressure, the smaller the pipe the lower the velocity. For example, in a 6 in. return line carrying 221,000 lb per hr of condensate from traps operating at 250 psig, the velocity will be 4.9 fps. In a ¾ in. line under the same pressure conditions the velocity will be only 1.1 fps.

The fact that velocity is lower in a smaller pipe might seem confusing at first. The reason is that the table is set up to provide the same head loss, or pressure drop, for every pipe size at a given steam pressure. Under these conditions here is what happens: Pipe friction, which affects liquid velocity, is due to the contact between the liquid and the pipe wall. The internal circumference of a ¾ in. pipe is 2.589 in. and the cross-sectional area is 0.533 sq in. In a 6 in. pipe the internal circumference is 19.054, the area 28.891. Thus we have a ratio of surface to area of 4.85 to 1 in the ¾ in. pipe, but only 0.66 to 1 in the 6 in. pipe. In the smaller pipe there is much greater friction in relation to the volume of water and so the velocity is proportionately less. Only by increasing the pressure drop in the smaller pipe could the velocity be stepped up.

How to Use Table

1) For Today's Conditions — You have a department that is condensing 10,000 lb per hr of steam at 125 lb pressure. Referring to the table, a 2½ in. line will handle 11,000 lb per hr and would take care of the job very well — today.

Or, you may have three separate process buildings with condensate loads as follows:

Bldg. No.	Bldg. Load	Total Load	Pressure	Pipe Size Cumulative
1	5,000	5,000	75	2
2	15,000	20,000	100	3½
3	10,000	30,000	100	4

Building 1 is farthest from the boiler. From the table, we find that a 2 in. pipe will handle 5100 lb per hr. At building 2, an ad-

GRAVITY, VACUUM AND HIGH PRESSURE RETURN PIPE SIZES

Condensate Capacities, Lb per Hr — Condensate Velocities, Ft per Sec

PIPE SIZE IN	GRAVITY RETURN		VACUUM RETURN		HIGH PRESSURE RETURN — STEAM SUPPLY PRESSURE, LB GAGE																			
					15		25		40		50		75		100		125		150		180		200		250	
	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.	Cap.	Vel.
¾					240	0.20	285	0.34	510	0.38	570	0.44	420	0.50	480	0.58	560	0.67	650	0.78	710	0.85	925	1.1
1	200	0.13	295	0.22	405	0.3	475	0.56	565	0.42	610	0.45	750	0.54	840	0.62	975	0.72	1105	0.82	1280	0.95	1405	1.04	1825	1.35
1¼	395	0.17	610	0.26	840	0.36	1040	0.44	1195	0.51	1285	0.55	1820	0.65	1750	0.74	2040	0.87	2300	0.98	2700	1.15	2925	1.25	3780	1.60
1½	570	0.18	955	0.30	1350	0.43	1610	0.51	1880	0.59	2070	0.65	2580	0.74	2675	0.84	3180	1.00	3585	1.15	4260	1.34	4700	1.48	6200	1.95
2	1100	0.21	2000	0.38	2840	0.54	3500	0.65	3940	0.75	4350	0.81	5400	0.97	5680	1.10	6700	1.3	7500	1.45	8780	1.70	9420	1.83	12400	2.40
2½	1720	0.25	3225	0.45	4720	0.64	5540	0.74	6520	0.87	7110	0.95	8400	1.12	9400	1.25	11000	1.47	12600	1.68	14550	1.94	15900	2.12	21000	2.80
3	2880	0.25	5400	0.47	8060	0.7	9500	0.86	11600	1.03	12900	1.12	15200	1.32	17400	1.51	19800	1.72	22450	1.95	25900	2.25	28200	2.45	34500	3.0
3½	4300	0.28	7900	0.51	12300	0.78	14700	0.93	17600	1.14	19400	1.25	22500	1.46	26000	1.68	29400	1.90	33100	2.14	38200	2.47	41500	2.69	51000	3.3
4	6500	0.32	10800	0.58	16700	0.85	20000	1.02	24400	1.24	25000	1.35	31000	1.62	36500	1.85	42000	2.13	47000	2.30	54000	2.75	58500	2.97	71000	3.6
5	11000	0.35	19400	0.62	31100	0.98	38250	1.22	47000	1.5	51200	1.67	60800	1.94	69200	2.21	78000	2.51	88000	2.86	101000	3.22	110000	3.50	134000	4.3
6	18000	0.40	36600	0.68	49600	1.09	60500	1.35	74000	1.64	82000	1.82	97000	2.16	112200	2.50	128000	2.85	145800	3.25	166000	3.70	184000	4.10	221000	4.9
Approx. Head Loss, Ft Per 1000 Ft*	0.25		0.75		1½		2½		4½		5½		8		9½		13		16		19		27	

*2 ft loss = about 1 psig loss

ditional 15,000 lb of condensate is dumped into the return line, making a total of 20,000 lb, which calls for 3½ in. pipe. The total load of 30,000 lb will take a 4 in. pipe. OK for today.

2) For Tomorrow's Load — Laundries, dry cleaning plants, and all industries using steam for heating and processing usually get bigger. New boilers are added, more steam using equipment is installed. Too frequently, a 1945 condensate return line is expected to handle a 1953 load. Because of this growth factor, over-sizing of return lines is good engineering practice but good judgment must be used. Don't tie up too much capital in a return line, but — by all means — don't put one in that's just large enough for today's load.

Here's an example: Assume a 10 in. steam supply header at 100 lb gage supplying 16,000 lb per hr with a pressure drop of 0.1 lb per 100 ft of pipe. This would call for a 3 in. return line. The head loss would be slightly under 8 ft or a little less than 4 lb*, because the load is a little less than the full load shown in the table. By increasing the pressure drop to 1.0 lb per 100 ft, the 10 in. steam line will supply 70,000 lb per hr of steam. The table calls for a 5 in. return line for this much condensate. If discharged to a 3 in. return line, the back pressure would rise sharply to 45 lb. Moral — Put in a comfortably oversize return line to begin with. Otherwise, you will have to replace the original return piping or add a second return header, either of which solution costs far more than anticipating future requirements at the time of original installation.

How to Install Return Lines

Return lines should pitch down from the point where trap discharge lines connect to the return line. If the condensate must be elevated, then:

1) Install an overhead return line where practical, and where the lift, in feet, plus back pressure, is not greater than, say, 25 percent of the initial steam pressure.

2) Install floor line return header pitching down to a lift fitting from which the condensate can be elevated vertically. For moderate lifts, back pressure caused by flash steam from the trap discharge will elevate the condensate.

3) Where condensate must be moved against excessive pressures caused by extra high lifts or undersized return lines, have condensate drain to receiver from which it can be pumped. Back pressure caused by flash steam will, of course, assist in the pumping operation.

Trap Discharge Lines Vs. Return Lines

The table shows a maximum capacity of 5680 lb per hr for a 2 in. return line where traps are operating at 100 lb. But according to its rating, a certain 2 in. trap at 100 lb pressure will discharge condensate at the rate of 18,000 lb per hr. This apparent discrepancy is resolved by bearing in mind that velocities in a relatively short trap discharge line safely can be much higher than in a long header handling condensate from many traps. The greater velocity is made possible by the high pressure drop between the trap and the return header.

Effect of Back Pressure on Trap Capacity

Where return line back pressure builds up due to excessive load, high lift, scale formation, pitting, etc., there will be loss of trap capacity.

Back Pressure, Percent of Initial Pressure	Capacity Loss, Percent
19	10
86	20
81	30
64	40
75	50

If the back pressure condition cannot be relieved, this trap capacity loss can be offset in either of two ways:

1) Install larger traps to give the required safety factor at the reduced operating differential pressure.

2) If the back pressure always will exist, even when traps are not operating, install larger orifices which involves new pressure change assemblies. With the larger orifices, the trap capacity will be restored to what it was with the higher pressure orifices and the greater differential pressure.

*Each 2 ft head loss equals approximately 1 lb per sq in. pressure drop.

QUESTION OF THE MONTH

IF YOU DON'T HAVE the answer to a problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange." You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2. . . . . Comment on a question about "conventional" and "packaged" boilers and their relative advantages and disadvantages is given this month, supplementing discussion of the matter in the March HPAC. Other readers are invited to express their views.

CHOICE DEPENDS UPON THE INDIVIDUAL SITUATION

IN REPLY TO THE published question on packaged boilers vs. conventional boilers, it would be best to begin with an understanding of what constitutes a "packaged" boiler. I am assuming that the questioner has in mind the fire tube, oil or gas fired steam generator with forced or induced draft fan, control panel, feedwater controller, pumps, gages, etc., all mounted on a structural steel base.

One of the main factors — although very often overlooked as such because it appears so obvious — is the choice of fuel. When investigation shows that solid fuel costs less, is readily available, and presents no particular problem of storage, ash disposal, etc., it would require more advantages than a "package" can muster to convince a smart operator, since no presently made packaged boiler uses coal.

Packaged boilers are limited in capacity. Where the load is of such magnitude as to require packaged boilers in large quantities, the number of men needed to properly operate and maintain them makes their use prohibitive.

Believe it or not, a client of ours would not consider the use of mechanical draft. Because of location, his plant was assured of reliable natural draft provided he erected a normally sized chimney. Due to a past experience, he felt strongly about the possibility of loss of capacity because of some mechanical or electrical failure in the draft system. This eliminated his acceptance of a packaged boiler.

The advantages of the packaged boiler lie in its flexibility, compactness, factory assembly, complete automatic operation, and lack of any special foundation. The packaged boiler serves well where a project consisting of a number of buildings to be ultimately fed by central heating distribution spans a number of years. Buildings erected before the completion of the central boiler plant or the steam conduit system can be served by a packaged boiler located in or adjacent to the buildings in question. In certain cases, we may have a central distribution system with one structure so remote from the others that at present it is not economical to run the conduit. Until such time as growth warrants extension of the steam piping to this remote building, a packaged boiler does the trick.

When classified as to type, the cost of buildings is still proportional to their cubage. To the client who is interested in low cost (and which one is not?), the low height of the packaged boiler is a great advantage and permits tucking a boiler in some unused space where no other will fit as well. Buildings adjacent to airstrips are best served by low chimneys. The draft system of a packaged boiler permits this. Of course, conventional boilers can also be provided with forced or induced draft.

Factory assembly of packaged boilers is an advantage for rapid installation in remote areas or overseas. Lack of skilled workers in some places need not deter use of these packages, since only relatively simple power, water, oil and stack connections are required. Once these are made, the automatic controls are put in command and steam is available.

Nothing has been said here regarding life expectancy or efficiency of

[*Concluded on page 119*]

HOW CAN WE PROTECT SNOW MELTING PIPING AGAINST CORROSION?

"Many sidewalk and driveway snow melting systems have been installed in the last several years in the Boston area, using various piping materials. Two of the systems using one material were laid on 8 in. crushed stone beds, over which 5 or 8 in. concrete slabs were poured, so that the pipes have been partly encompassed by the concrete. One of the systems using another pipe material was laid in a reinforced concrete slab so that the pipes were completely covered with concrete. These systems have been installed and in operation for a period of three or four years.

"Because of a necessary excavation, the partly concrete covered pipes were recently uncovered. It was found that the exterior lower surface of the pipe was pitted and that at a pipe joint the lower section of the weld had "washed" away. Recently, several leaks occurred in one of the totally enclosed pipe systems. After getting to the pipe and examining several samples, considerable pitting on the exterior surface was evident and there were several pinholes through the pipe wall.

"One of the explanations for the above conditions is that there is severe electrolytic action present and this action is causing the wasting away of the metals.

"We would be interested in having any information as to the cause and cure for these conditions. Are there any known steps to be taken in the design of new systems of this type to prevent these conditions?"

[*You are invited to answer or comment on this question from a reader of HPAC for publication here. Please address your remarks to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*]

ANYTHING CAN HAPPEN

Piping Records of Past Tell Us What Not To Do

By C. T. Baker
Consulting Engineer

• *Almost anything can happen when you're in the engineering or operating or contracting (or sales) ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss practical problems that need solving — and ways to solve them.*

THE ENGINEER CAN LEARN valuable lessons from records of past occurrences. In fact, one of the greatest advantages in using the eyes of the present to study the past is that the engineer discovers that knowing what not to do can be just as important as knowing what to do.

The Case of the Leaking Exhaust Pipe

A cross compound condensing corliss engine, directly connected to a large duplex ammonia compressor, had operated for a number of years under a vacuum of 16 to 17 in. According to the size of the condenser and the volume of condensing water supplied to it, the vacuum gage should have read 24 to 26 in. In addition to this big corliss engine, a 150 kw engine generator set exhausted to the same condenser.

After years of wasteful operation, a new chief engineer was employed. Like the man before him, he searched for the cause of the poor performance of this equipment and good judgment led him to the seat of the trouble.

The exhaust piping had been laid — for the most part — in a concrete trench in the engine room floor. Sand covered it, with a light layer of concrete on top. Preparing to make a test for leaks, the new chief had all the sand and concrete removed from the pit. The exposed piping revealed a large tee that had been installed at the end of the exhaust main. The engine room crew said that it had been placed there to provide an opening for connecting another generator set which had never been purchased. By bolting a blank flange in place, using a very thin metal plate, the side outlet of this fitting had been closed.

It was evident that, very early in the history of this installation, atmospheric pressure acting on the exposed area of the thin plate had caused it partially to collapse. This naturally destroyed the joint between the plate and the 10 in. tee, permitting air to enter, even though a rubber gasket had been used to insure a tight joint.

Replacement of the thin plate with a heavy blank pipe flange and a new gasket cured the trouble and the vacuum gage immediately assumed the correct position — it read 25 in. No further difficulty was experienced.

This equipment had been placed in service in 1913 and had operated with a leaking exhaust pipe joint until 1921. The difference in steam rate in the operation of these engines at 16 in. and 25 in. vacuum represents the loss of many barrels of fuel oil during the 11 years that elapsed between the failure of the joint and its discovery.

The Case of the Compressor Discharge Pipe

To gain additional cooling capacity, a 6½ in. x 6½ in. vertical ammonia compressor was installed in a meat packing plant in the early 1920's. Trouble soon developed in the compressor discharge line, and after repairing successive leaks that occurred within a short period, an outside engineer was asked to try to locate the trouble. This he did very quickly.

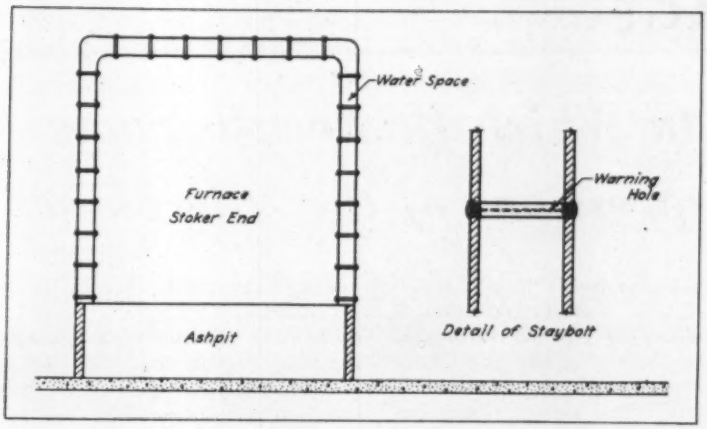
On the discharge line, a right angle elbow had been placed hard against a brick partition wall near the point where the pipe entered the condensers on the opposite side of the wall. Chipping the wall away for an inch or so behind the elbow "saved the patient" and the operation allowed room for the pipe line to expand freely.

Moral: Never overlook the fact that pipe lines will expand when warmed a few degrees above the ambient temperature.

The Case of the Broken Stay Bolts

A stoker fired, firebox type steam generator, rated at 60 hp, was operated at about 100 lb pressure. The firebox section (see the accompanying sketch) was braced in the usual manner with stay bolts and, as is usual also, the stay bolts were drilled to provide a warning signal in case of failure.

From the start, a great deal of trouble was caused by the stay bolts, which had a habit of pulling in two — generally on a Monday morning, after the boiler had been idle over the weekend. The reasons given for this were as numerous as the people who advanced them. The boiler repair man told the owners that the stoker was far too big for the boiler and that was the seat of the trouble (notwithstanding that the boiler never operated beyond 75 percent



STAY BOLTS HAD A HABIT of pulling in two — generally on a Monday morning, following the weekend shutdown of the boiler. Trouble was finally prevented by providing freedom of expansion for the blowdown piping

of rated capacity and never carried over 100 lb of steam pressure).

Another "authority" advised that all doors and windows of the small boiler room be kept tightly closed during the winter months. He pointed out that cold outdoor air was not supposed to come in contact with the hot boiler, and the fact that the boiler was well insulated failed to influence his thinking. This advice sounded good to the management and they gave orders that the boiler room was to be kept closed at all times and that the fireman was to see that no windows or doors were opened except in case of absolute necessity.

The only thing wrong with this plan was that the stoker was unable to hold the steam pressure up to normal and the boiler could not produce steam in the quantities needed.

Later, someone reasoned that considerable air is needed to burn coal and since the boiler room was hermetically sealed, the boiler didn't stand much chance of making steam. With one window open, the boiler performed satisfactorily and generated all the steam required, but the stay bolts continued to break.

In the course of events, I was called in to make an inspection and subsequently uncovered some interesting facts.

The boiler was properly anchored at the front, or stoker end but, unfortunately, it was also anchored at the opposite end. Two blowdown connections were connected to a common blowdown pipe which extended downward through a 4 in. thick concrete floor, then through 10 ft of closely packed earth, and finally — assuming a horizontal position — extended 10 ft more to its termination over a small ravine. So securely anchored, it was totally impossible for the steam generator to move freely while being heated from a room temperature of around 50 F at its start on Monday morning, to furnace temperature.

To remedy the situation, the blowdown piping was dug up and replaced in such a manner as to insure plenty of expansion freedom. All fittings between the boiler and the blowoff valve were replaced to insure that none that might have been damaged by the forces of expansion was continued in service.

In addition to this change, an automatic damper closing device was installed and wired to the stoker so as to close the damper after the stoker cut out and to open it again just ahead of the stoker's starting. This measure was taken to save fuel. By reducing the stoker operating time by closing the damper immediately following the stoker shutdown, the furnace and boiler proper were not cooled so rapidly as formerly, and holding the furnace heat in retained steam pressure for a longer period after the stoker stopped.

Whatever the causes of the stay bolt failures, there have been no recurrences since the changes were made.

QUESTION OF THE MONTH —

[*Concluded from page* 117]

boilers, since these are great variables differing with various manufacturers and dependent upon the operation and care given the boilers.

Despite its sounding trite, the logical conclusion one must draw from the above is that each situation must be studied and evaluated in the light of the particular conditions.—MILTON DORMONT, P.E., Chief Engineer, Mackenzie, Bogert & White, Architects & Engineers.

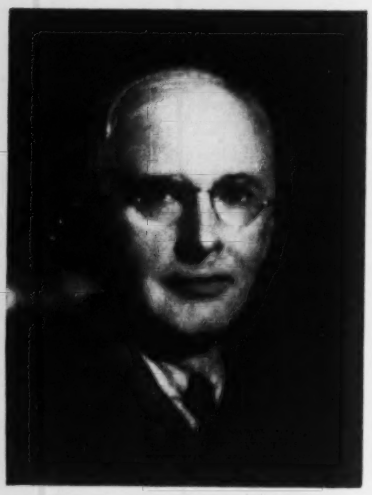
MULTIPLE BOILERS FOR SCHOOLS, DEPARTMENT STORES

MULTIPLE BOILER arrangements using packaged boilers have proved to be an ideal solution to the heating problem in the one story "campus style" school buildings which are now being constructed in South Carolina under the school expansion program. These buildings are designed so that they can be readily expanded by adding a group of rooms in the form of a wing. Each wing has a separate boiler which occupies space equivalent to a coat closet. This type of system is very flexible and permits separate zone control, making it possible to heat only those areas required for special meetings.

Multiple boilers were used also to excellent advantage in the Belk-Simpson department store in Greenville, S.C. Four units were located in a penthouse and arranged in step control to meet the required load. This arrangement resulted in a fuel saving of approximately 40 percent and released the entire sub-basement for storage. It also eliminated an expensive masonry chimney.

This discussion is not intended to compare packaged boilers with conventional boilers for central station installations, but rather to point out advantages which are possible with packaged boilers.—FRANCIS W. FREEMAN, Chief Engineer, General Wholesale Co.

SAM LEWIS' PAGE



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. By request, he recalls this month some of his impressions of the International Heating, Ventilating and Air Conditioning Exposition which was held earlier this year

In Which He Recalls Some Impressions of the "Big Show"

THE INTERNATIONAL Heating, Ventilating and Air Conditioning Exposition — held earlier this year at the International Amphitheatre, Chicago — is behind us. . . . but its memories linger on. It was a remarkable and an enormous show.

I could have spent more time there. I keep hearing from clients about exhibits that I missed. An outstanding impression is the number of visitors, even though the exposition was not open to the public.

Charles F. Roth, manager of the exposition, honored me — as a past president of the American Society of Heating and Ventilating Engineers — by sending me a block of tickets bearing my name. So excellent was the promotion and advertising for the exposition that my tickets all were requested by clients and possible clients before the exposition opened.

My general first impression was that the representatives of the exhibitors were a tired-looking lot, and that the concentrated tobacco smoke made my eyes smart. The most arresting exhibit, to my mind, was that of the research studies done at the University of Illinois, which showed, by temperature-indicating instruments, the physical reactions of a young lady to sudden and radical changes in temperature and relative humidity. This exhibit represented in part the 1953 culmination of years of research by the ASHVE and the cooperative U. of I. The work has also been supported by the U. S. Public Health Service.

So excellent was the demonstration that air conditioning engineers and health administrators have asked that the entire exhibit be presented, by the joint participants, at the coming meeting in New York of the American Medical Association.

The exposition was noteworthy for the number of machines in actual operation — such as boilers, stokers, refrigeration compressors, and temperature and moisture controlling devices. The exhibition hall, even though sometimes hot and odorous, fortunately could allow several temporary chimneys. I remember particularly the tremendous radiant heat coming from a little forced draft anthracite stoker on display.

There were lots of unit heaters and convectors and several attractive examples were shown of a year-around unit heater-cooler. It has a very quiet motor-driven fan and a gilled convector for chilled water circulation in summer and for hot water circulation in winter. Provision is made for outside air intake and for air recirculation in varying proportions. Because of the possible influence of time-lag, I might hesitate somewhat before attempting to use the same heat transfer device for both liquids. A cooling coil could come first and a heating coil could follow, across the air stream, each served by separate pipe mains. The first coil, with chilled water, if cold enough and big enough, would reduce the air to a chilly saturated condition, and on a very hot day I would expect discomfort unless the second coil could be depended upon to reheat the air a trifle.

In this vigorous and inspiring latitude, we find many days during which some heat will be gratefully received in the morning on one orientation of a building, while refrigerated cooling is imperative in the afternoon.

There were flocks of one-fuel boilers at the exposition. I like the term "one-fuel boiler", though the name isn't yet entirely satisfactory as to description. I mean by the term a big scotch boiler adapted to reasonably high pressure but limited to burning gas or oil. Such a boiler has a small combustion chamber or tube with the mixing device for fuel and air at one end. The products of combustion impinge on a dry-back, refractory-faced target and return through many small tubes to the front end of the boiler, where they pass to the breeching.

I saw at the exposition several beautifully fabricated centrifugal and reciprocating machines in rapid motion. I balanced a coin on some of these — and the coin stood still without any glue or chewing gum to hold it.

I did not find any automobile air cooling exhibits, though many of the manufacturers of pleasure vehicles have built successful machines. Refrigerated trucks are a well established necessity, and refrigerated passenger carriers are desirable.

I noted diffusers and grilles and noise absorbers, as well as many examples of the influence of advanced chemistry in its effect on heating and ventilating and air conditioning.

When the next exposition time arrives, I wish to be living in some other city than the one in which the show is held — so that I shall not be occupied, during its progress, by the pleasure of entertaining out-of-town guests, or by the ground-down nose on my own desk.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Room Air Distribution Research for Year 'Round Air Conditioning

Part I — Supply Outlets at One High Sidewall Location

By S. F. Gilman*, H. E. Straub**, Urbana, Ill., A. E. Hershey†, East Pittsburgh, Pa., and R. B. Engdahl††, Columbus, Ohio

SUMMARY — The initial results of a research project concerning room air distribution for residential year 'round air conditioning are presented.

With several types and sizes of supply outlets at one high sidewall location, studies of the air distribution in a test room were made under both summer cooling and winter heating conditions of operation. The effect of varying the flow rate and velocity of the supply air, the type and deflection setting of the supply outlet, and the location of the return intake are discussed.

The next phase of the air distribution research project will deal with floor registers of both the conventional and perimeter types at various locations in the test room.

ALTHOUGH engineering methods have been developed for designing winter heating systems and, to a lesser degree, summer cooling systems for residences, the combining of the heating and the cooling operations into a year 'round air conditioning system presents several new and unsolved problems in both duct and room air distribution.[1] In the year 'round air conditioning of residences, economic reasons and operation simplicity normally require that the same supply outlets be used for both the winter heating and the summer cooling operations. As a consequence, one of the problems unique of the year 'round system is that of distributing heated air in winter and cooled air in summer from the same supply outlets in such a manner that satisfactory comfort conditions are maintained at all times. Although the effectiveness of the air distribution in a residence is an extremely important factor in the overall performance of the air conditioning system, engineering data for selecting the proper types and locations of supply outlets utilizing both heated and cooled air are not available. The rapidly accelerating rate at which year 'round air conditioning is being installed in residences emphasizes the need for air distribution research to obtain such data.

A research project on air distribution in rooms was initiated at the University of Illinois during the latter part of 1939 and continued until April 1942, at which time the members of the staff working on it entered the Armed Forces or industries engaged in war work. The first year of work on the project was devoted to modifying an existing test plant and to developing instruments for the air distribution studies; a paper covering this work has been published.[2] Since a report of the research conducted between late 1940 and April 1942 has not been published, the principal results obtained during this period are included in this paper.

In September 1950, the project was reactivated by the University and since June 1951 has been jointly sponsored by the *American Gas Association* and the Engineering Experiment Station of the University of Illinois. This paper also reports the work done and research conducted since September 1950.

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††Supervisor, *Battelle Memorial Institute*. Member of ASHVE.

[1]Exponent numerals refer to References.

Presented at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

Objective and Scope

The object of this portion of the air distribution program is to obtain engineering data for selecting the proper types and locations of supply outlets which will give satisfactory air distribution in residential rooms during all seasons of the year.

Observations were made of the air temperatures, velocities, and flow patterns existing at numerous points in a test room under various winter heating and summer cooling conditions of operation. The principal variables are the flow-rate (cfm); the temperature and velocity of the supply air; the location, type, and deflection setting of the supply outlets; and the location of the return intakes. Although the heating load, cooling load, and room size are presently being held constant, these factors may be introduced as variables later in the research program.

The research completed has involved several commonly used types and sizes of supply outlets installed at a single high sidewall location. Additional studies with supply outlets at other high sidewall locations are to be conducted later in the program, possibly after completing the current phase of the project which deals with floor registers of both the conventional and perimeter types.

Description of Apparatus

Since much of the equipment has been described in detail previously,[2,3] only a general description of the apparatus is given except for modifications or additions made subsequent to 1940.

A diagram of the room heating and cooling test plant is shown in Fig. 1. The test room is 13¾ ft wide and 18 ft long, and has an 8½ ft ceiling height. The walls are of typical frame construction with no insulation. The west wall is a duplicate of the east wall, having one window and one door in the same relative location; the south wall has neither doors nor windows. There is an attic space above and a basement space below the room, and entry to these spaces is provided by cold-storage doors. The attic, room, and basement are enclosed by a larger insulated structure, not shown in the figure, which forms corridors along the east, north, and west walls of the test room. An insulated partition wall containing cold-storage doors separates the north and west corridors; hence the west corridor can be isolated from the north and east corridors.

Direct expansion refrigerating coils in the north corridor are connected to a 12-ton capacity ammonia refrigeration plant (not shown) located on the floor below the test plant. Independently controlled banks of electric heaters are located in the corridors and in the attic space. The basement space contains both electric heaters and chilled-water coils. Fans in the basement space and in the corridors aid in minimizing temperature variations.

This arrangement, by using the proper combination of cooling coils, electric heaters and cold-storage doors, makes it possible to operate the test room under a large variety of simulated winter and summer conditions; for example, with either two or three "exposed walls", with temperatures of from 0 F to 130 F in the corridors, and a range of temperatures in the basement and attic spaces.

Approximately 70 thermocouples are located at various points in and on the walls, floor, and ceiling of the test room and in the corridors, attic, and basement spaces. Additional thermocouples are located a few inches inside the supply opening and the return intakes. All thermocouple readings are taken at the instrument panel located on the floor below the test plant. The equipment at the instrument panel includes approximately 200 switches and two potentiometers — a laboratory type and an electronic self-balancing type.

Referring to the lower portion of Fig. 1, the air supplied to the test room is drawn through the cooling and heating coils by a variable speed fan that permits operation at any desired capacity between 50 and 400 cfm. After leaving the conditioning equipment the air passes through the

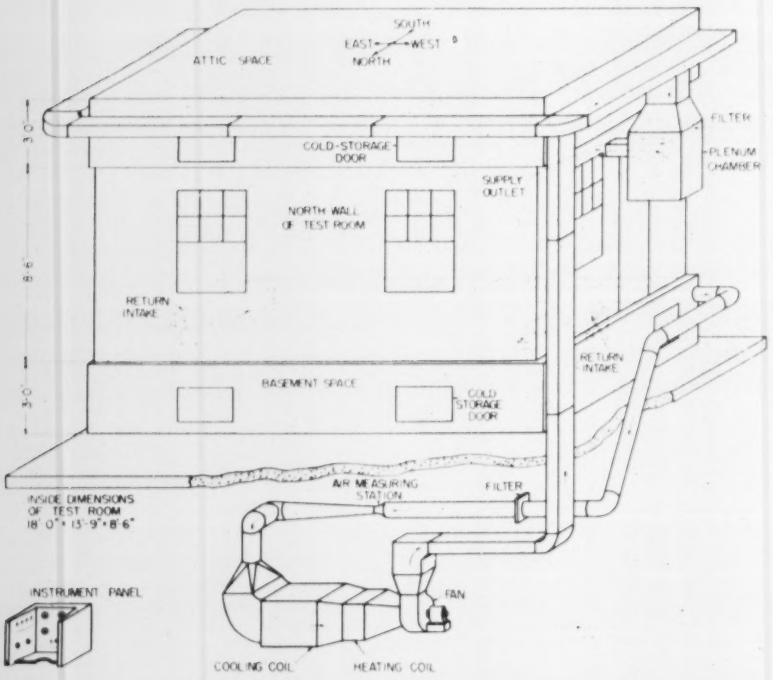

Fig. 1—Diagram of room heating and cooling test plant

supply duct and through a filter into the plenum chamber; it then enters a 27 in. long section of horizontal duct and discharges into the room through the supply outlet. The width and height of the horizontal duct section are the same as those of the particular supply outlet being studied. When a different size of supply outlet is to be installed, the horizontal duct section is removed and replaced by another of the proper size.

The center of the supply outlet is 1 ft below the ceiling, 8 ft from the north wall and 5¾ ft from the south wall. This location is as near the center of the west wall as the construction of the room permits. The temperature of the supply air can be maintained at any desired value between 55 and 165 F. Leaving the test room, the air enters one of the 28 in. x 5 in. baseboard return intakes (the other being closed), passes through a filter in the return duct, through a nozzle to measure the airflow rate, and re-enters the conditioning equipment.

Fig. 2 depicts a portion of the interior of the test room as viewed looking east from a position near the supply outlet. The return intake located in the east wall can be seen at approximately the center of the baseboard. The device on wheels in the foreground is a vertical rack that can be moved to any desired location along the length of the room by an electrically operated mechanism located outside the room. The rack supports 33 identical heated-thermocouple anemometers for measuring air velocities and air temperatures. The arrangement of the anemometers on the rack is flexible. The leads from these anemometers pass out of the test room through the flexible cable on the right of the rack and connect with switches at the instrument panel (Fig. 1), where the temperature and velocity readings are taken.

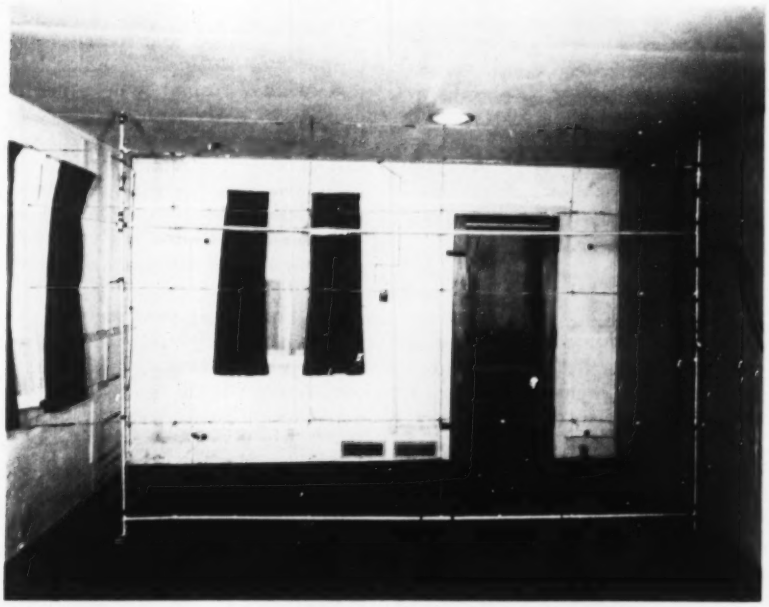

Fig. 2—View of interior of test room, looking east

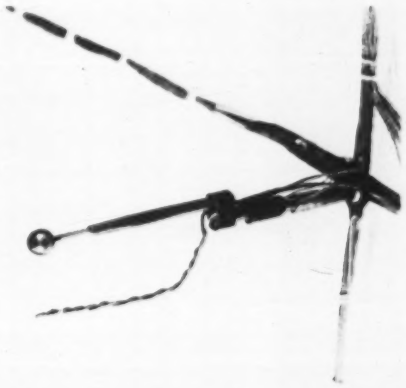

Fig. 3—Photograph of heated-thermocouple anemometer

One of the heated-thermocouple anemometers with its supports is shown in Fig. 3. The anemometer was developed by the 1941 research staff and is more nearly non-directional than the one previously reported.[2] The circular-shaped object at the left is a copper sphere of ¼ in. diameter and 0.01 in. wall thickness. Inside the sphere is a tiny electric heater which is regulated to maintain a constant heat output. One junction of a thermocouple is embedded in the surface of the sphere; this is the heated junction. The other junction is located about ¾ in. away (left end of twisted wires); this is the unheated junction. The electromotive force (emf) generated between the two junctions is primarily a function of the velocity of the air stream passing over the instrument, and the relationship for each anemometer is determined by calibration. The principal construction details and a portion of the wiring diagram are shown in Fig. 4. The wiring diagram indicates how the air temperature, as well as the velocity, is measured.

Calibration of Apparatus

The inclined draft gages used to measure the various pressures were calibrated with a micromanometer[4] to

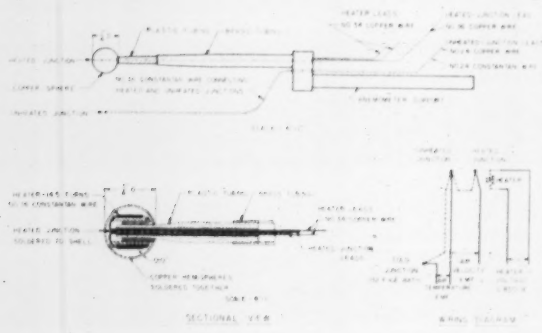

Fig. 4—Principal details of heated-thermocouple anemometer

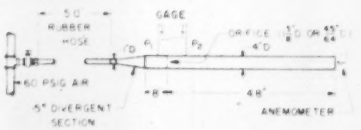

Fig. 5—Anemometer calibrating tube

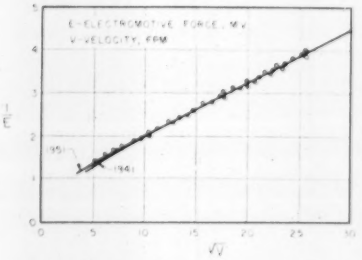

Fig. 6—Calibration curves for heated-thermocouple anemometers

obtain curves for correcting the gage readings to their true values.

The anemometers used in the test room were calibrated individually in a wind-tunnel[2] over a range of 20 to 2000 fpm velocity by the 1941 research staff and then installed in the room. One additional anemometer, designated the *wind-tunnel anemometer*, was also calibrated and kept in the basement near the wind-tunnel. When the air distribution project was reactivated in 1950, the calibrations of the nozzles in the wind-tunnel were checked and found to be unchanged. The next step was to check the calibrations of all of the anemometers; this was necessary because the emissivity of the copper spheres could have changed considerably in the nine-year period.

In order to avoid breaking the sensitive electrical connections to the anemometers mounted on the rack in the test room, recalibrating them in the wind-tunnel, and then reconnecting the electrical circuits, a means of calibrating the anemometers in place was developed. This was accomplished by means of a portable *calibrating tube*, the details of which are presented in Fig. 5. Air from a 60 psig source was throttled through a valve to nearly atmospheric pressure. It then flowed through 50 ft of rubber hose into a 15 deg divergent section of sheet-metal duct; thence through a thin-plate orifice in the 4 in. diameter main section of the calibrating tube. With the recalibrated wind-tunnel anemometer installed at the exit of the tube, the relationship between the static-pressure differential across the orifice and the air velocity at the exit of the tube was established. The calibrating tube was then taken into the test room and used to calibrate each of the 33 anemometers in place on the rack. Representative calibration points and a mean curve are shown in Fig. 6. None of the more than 400 calibration points obtained for the anemometers deviated by more than 10 percent from the curve. This 1951 calibration applies over the range of air temperatures used in this investigation provided the air stream is within about 45 deg of meeting the anemometer head-on. When the direction of the mean velocity is outside this range, corrections must be applied. The calibration curve obtained in 1941 is also presented in Fig. 6. Comparison of the 1941 and 1951 curves indicates the excellent stability of the anemometer calibration over long periods of time.

Test Conditions

Throughout the studies being reported, the arrangement of the anemometers on the rack was as shown in Fig. 7a. The average temperature at anemometers 8, 9, 10, and 11, when the rack was placed in the center of the room (position 4, Fig. 7b), was selected as the control temperature for the room conditions. This control temperature was maintained at 75 F during both the winter heating and summer cooling tests.

Likewise, all studies were made with two "exposed walls"; the north and the east walls. The west corridor, which was isolated from the north and east corridors, was maintained at approximately the test room temperature of 75 F; consequently, the west wall functioned as an "inside" wall of a room. The south wall also functioned as an inside wall, the space behind it being about 75 F at all times. Except for one test simulating an unheated crawl-space condition, the temperature in the basement space was maintained at 75 F. The single-glass windows of the test room were closed and locked. For purposes of calculating infiltration, these windows would be described as *average-fit*. Although three desk-type fans were used in the north and east corridors to minimize temperature variations, the wind conditions on the external surfaces of the room, in terms of pressures and velocities, are judged to be about a 2 or 3 mph wind condition.

For the heating tests under simulated winter conditions, 0 F was originally selected as the desirable air temperature in the north and east corridors. However, since 6 F was the lowest temperature which could be maintained with the refrigeration equipment, the winter heating studies were actually conducted at an "outdoor," or corridor, temperature of 6 F. The temperature in the attic space above the 4 in. batts of insulation between the ceiling joists was ap-

proximately 35 F. This temperature was regulated by setting the cold-storage doors in the north and east walls of the attic space in their wide-open positions when the corridors were at 6 F.

The indicated steady-state conditions fixed the heat loss of the test room for the simulated winter conditions. The cubic feet per minute of heated supply air required to maintain a space at a desired temperature is:

$$Q_w = \frac{H_w}{(60)(0.24)d_r(t_w - t_r)} \quad \ldots\ldots (1)$$

where

Q_w = flow rate of supply air, cubic feet per minute at density d_r.

H_w = heat loss of space, Btu per hour.

d_r = density of return air, pounds per cubic feet.

t_w = supply-air temperature, Fahrenheit.

t_r = return-air temperature, Fahrenheit.

As the return-air temperature in the test room was very nearly 71 F and of density 0.072 for all heating tests, these values can be substituted in Equation 1. The result is:

$$Q_w = \frac{H_w}{1.04(t_w - 71)} \quad \ldots\ldots (2)$$

Since the heat loss H_w was fixed by the external conditions imposed on the test room, the selection of a value for t_w determined the flow-rate Q_w, and vice versa. The higher the selected value of t_w, the lower would be the flow rate. Therefore, the test room could be maintained at the desired temperature with either a large flow rate of relatively low temperature supply air or a small rate of relatively high temperature air. In general, tests were conducted with flow rates of approximately 100, 230, 260, and 310 cfm, resulting in supply-air temperatures of about 143, 103, 97, and 93 F. These flow rates correspond to 3, 6½, 7¾, and 9 air changes per hr, the first being representative of winter heating practice and the last three of summer cooling practice.

Although the heat loss H_w of the room was fixed, its value was not known. However, it could be determined in two ways — either by measuring Q_w, t_w, and t_r and then using Equation 1, or by making a heat loss calculation on the test room. Since equipment was available for accurately measuring these quantities, the heat loss of the test room was normally evaluated by Equation 1.

For one of the test conditions, this equation yielded a value of 7500 Btuh for H_w. For the same conditions, heat loss calculations using the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1952[3] yielded a value of 8150 Btuh, 11 percent greater than the 7500 Btuh actual load obtained by Equation 1. The difference between the two values may be attributed to such factors as the tight construction of the test room and small safety factors in the published U and k values of materials.

In order to establish representative test conditions for the summer cooling studies, a procedure different from that used to establish the winter conditions was required. This was made necessary by the lack of facilities to duplicate solar radiation effects on the room. In determining the simulated summer conditions, the test room was considered as being one room of a residence. The sensible cooling load was calculated for four different orientations of the room by the method given in the HEATING, VENTILATING, AIR CONDITIONING GUIDE 1951; Chapter 12, Tables 12, 13, 17, and 25; and Chapter 2, Table 2. The following design conditions were used in the calculations: 40 deg north latitude location, 95 F outdoor design dry bulb temperature, 75 F indoor dry bulb temperature, canvas awnings on the windows, and no internal heat gains with the exception of two adults seated at rest. The four orientations used and the resultant curves relating time of day to sensible cooling load are shown in Fig. 8. From these curves a value of 5000 Btuh, shown as a dotted line in the figure, was selected as a representative cooling load to impose on the test room. When this value is inserted in the equivalent form of Equation 1 for summer cooling and for air at standard density, the result is:

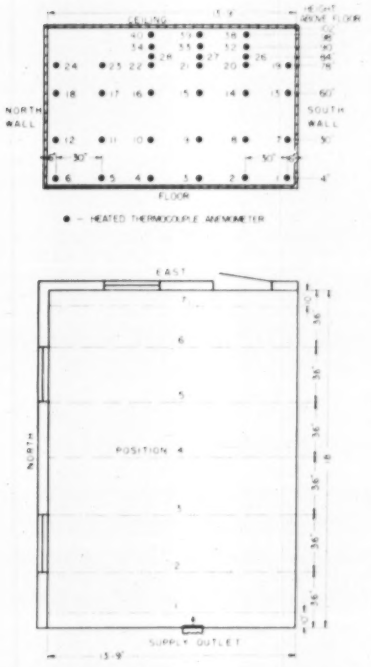

Fig. 7—Arrangement of anemometers

NOTE: Upper diagram designated 7a shows arrangement of anemometers on rack relative to interior surfaces of test room. Lower diagram designated 7b shows positions of anemometer rack along length of test room.

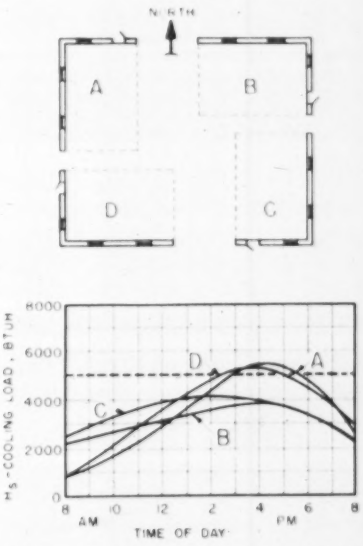

Fig. 8—Relationship between time of day and sensible cooling load of test room for four orientations

Table 1—Studies With Free Openings as Supply Outlets[a]

Test No.[b]	Height of Free Opening[c], Inches	Room Air Temp, F	Supply Air Temp, F	Temp Differential, F	Outlet Velocity, fpm	Return Intake Location[d]	Cooling Load, Btuh
1	5	76	65	11	770	West	4300
2	5	83	83	0	770	West	0
3	5	79	79	0	770	West	0
4	5	76	65	11	770	West	4400
5	5	77	65	12	770	East	4600
6	10	80	65	15	390	East	5700
7	10	79	65	14	390	West	5700
8	5	81	65	16	770	East	6100
9	5	80	65	15	770	West	5700
10	3¼	80	65	15	1230	West	5900
11	3¼	80	65	15	1230	East	5900
12	4	79	65	14	960	East	5700
13	4	80	65	15	960	West	5900
14	6½	79	65	14	590	West	5600
15	6½	80	65	15	590	East	5800
16	6½	80	65	15	590	West	5600
17	6½	80	65	15	590	East	5800
18	6½	72	72	0	590	West	0
19	6½	75	75	0	590	East	0
20	6½	79	65	14	590	West	5200
21	6½	80	65	15	590	West	5900

[a]Flow rate for all tests: 580 cfm (10.8 air changes per hour).
[b]Tests Nos. 1-15 conducted in 1941-42.
[c]Width of free opening is 14 in.
[d]See Fig. 1 for supply outlet and return intake locations.

$$Q_s = \frac{5000}{1.08(75 - t_s)} \qquad (3)$$

Since representative temperature differentials between the supply air and room air are 15 F and 20 F, supply air temperatures t_s of 60 and 55 F were substituted in Equation 3 to determine the flow rates for the cooling studies. The resulting two values of Q_s were 308 and 232 cfm.

The summer cooling conditions were then obtained in the following manner: The electric heaters in the attic space above the insulated ceiling were set to maintain the attic temperature at 120 F. Next, the fan speed was adjusted until the flow rate Q_s was about 308 cfm as determined by the measuring station (Fig. 1). Then with the automatically controlled supply-air temperature t_s set at 60 F, the electric heaters in the north and east corridors were adjusted until the control temperature in the test room stabilized at 75 F. Three to four days of continual adjustments were required to obtain a steady-state condition. The resulting outside surface temperature of the two exposed walls was about 115 F. Since the design outdoor temperature was 95 F, it is evident that the simulated outdoor temperature had to be raised considerably in order to produce the effects of solar radiation on the sensible cooling load of the room. The other cooling condition using 232 cfm and 55 F supply-air temperature was obtained in a similar manner.

The essential difference between the methods used in establishing winter and summer conditions is the following: For winter heating, representative outdoor conditions were imposed on the test room and the resulting actual heating load was measured; whereas for summer cooling, a representative cooling load was selected using Fig. 8 and the outdoor conditions (north and east corridor temperatures) were adjusted until the selected cooling load was obtained.

General Procedure

At the beginning of each winter heating and summer cooling test the anemometer rack was placed in the center of the room in position 4; this position, as well as others used during each test, is shown in Fig. 7b. The desired test conditions were then imposed on the room and adjustments made until the desired steady state was obtained. The temperature emf and velocity emf at each of the 33 stations on the anemometer rack were then read on the electronic potentiometer at the instrument panel, and the temperatures and velocities obtained from calibration curves or tables. Next, the anemometer rack was moved to position 1 where another traverse of the temperatures and velocities was made. As previously stated, the rack was moved by externally controlled equipment so that entrance into the room was not required during this phase of the test. Similar traverses were made at positions 2, 3, 5, 6 and 7. Finally, the rack was again moved to position 4, and a check made to insure that conditions had not changed during the four-hour period required to make the traverses.

The investigators then entered the room with smoke apparatus and a commercial anemometer of the hot-wire type. Smoke was used to determine the direction of the lower velocity air currents at numerous points in the room, and also the general motion of the air masses in the room. The commercial anemometer was used to measure the air velocity at numerous points in the occupied zone, as well as to determine the jet characteristics close to the supply outlet and at some distance away. The portion of the test conducted with investigators in the room required about three hours.

Using this procedure, tests were conducted under both winter heating and summer cooling conditions with various sizes of supply outlets ranging from 14 x 10 in. to 14 x 4 in. and with air-flow rates between 105 and 380 cfm. The following types of supply outlets were used: free openings (holes in the wall), commercial shallow-vane and deep-vane grilles, and commercial shallow-vane registers. The shallow vanes were about $\frac{3}{8}$ in. deep and the deep vanes about $\frac{3}{4}$ in. deep. Each supply outlet was located high in the center of the west wall as shown in Fig. 1, and the return intake was located in the baseboard of either the west or east wall.

Free Openings — Results and Conclusions

The studies with free openings as supply outlets are described in Table

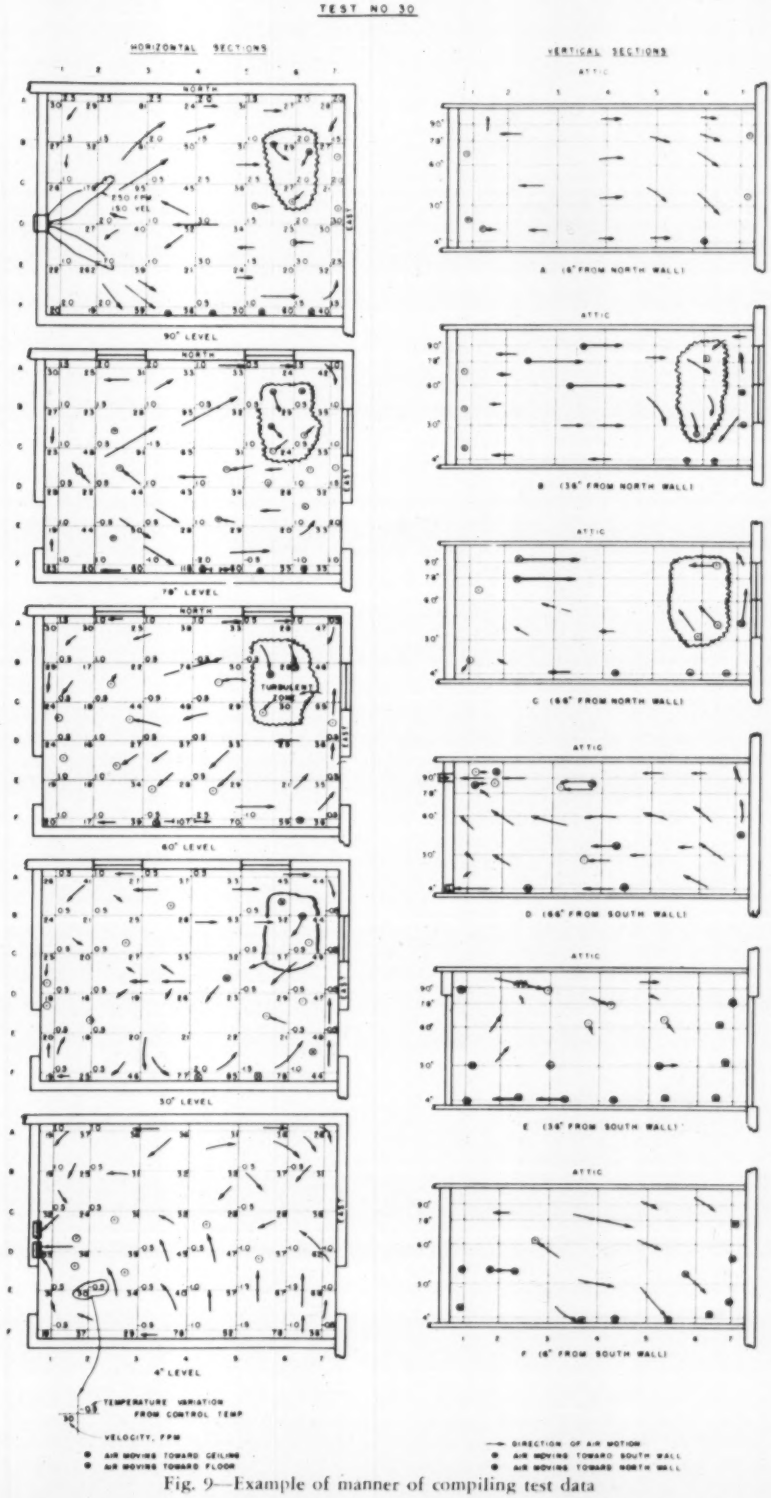

Fig. 9—Example of manner of compiling test data

1. The first 15 tests were conducted in 1941-42, but have not been reported previously. Since the test conditions used at that time differ somewhat from those currently in use, the discussion of test conditions given in a previous section of this paper does not apply to these.

Fig. 9 exemplifies the method used to compile the principal data obtained for each test. Such diagrams, combined with supplementary data, served as the basis for analyzing and interpreting the data from all tests. The vertical lines numbered 1 through 7 refer to the seven positions of the anemometer rack in the room (Fig. 7b). The left side of the figure shows five horizontal sections of the room at the 90, 78, 60, 30, and 4-in. levels. The horizontal lines, lettered *A* through *F*, along the left edge refer to the locations of vertical columns of anemometers relative to the north and south walls. Referring to Fig. 7a, as the rack is moved the column comprised of anemometers 6, 12, 18 and 24 travels along line *A*; and the column comprised of anemometers 1, 7, 13, and 19 travels along line *F*. At each intersection of a horizontal and a vertical line in the diagrams on the left side of Fig. 9, the upper number indicates the temperature variation from the control (room) temperature and the lower number indicates the velocity—for example, at the 4-in. level at *E*-2, the temperature is 0.5 deg below the control temperature of 75 F, and the velocity is 30 fpm. Where no temperature value is given, the deviation is zero.

The right side of Fig. 9 shows six vertical sections of the room. The top diagram is a vertical section lying along the lines marked *A* in the diagrams on the left side of the figure. If these six vertical sections were cut out of the page and fixed in upright positions, and then if the five horizontal section views at the left were sandwiched into these vertical sections in an egg-crate manner, a three dimensional representation of the temperature variations and velocities at 231 points in the room would be obtained.

The principal purpose of Tests

Table 2—Studies With Shallow- and Deep-Vaned Supply Outlets

Test No.	Outlet Type	Height of Outlet[b] Inches	Vertical Vane Setting	Horizontal Vane Setting	Room Air Temp F	Supply Air Temp F	Temp Differential, F	Outlet Velocity, fpm	Return Intake Location[c]	Flow Rate, cfm	Air Changes Per Hr	Load, Cooling or Heating, Btuh
22	Shallow Vane	8	*A*	—	76	60	16	600	West	315	9	4800
23		8	*A*	—	75	60	15	600	East	315	9	4500
24		8	*A*	—	74	55	19	450	West	230	6½	4300
25		8	*A*	—	74	55	19	450	East	230	6½	4200
26		8	*B*	—	75	55	20	410	West	230	6½	4400
27		8	*B*	—	75	60	15	580	West	315	9	4700
28		8	*C*	19° up	75	60	15	560	West	315	9	4700
29		8	*D*	28° up	76	56	20	410	West	230	6½	4700
30		8	*E*	—	78	59	19	420	West	260	7¾	5000
31		6	*E*	—	78	58	20	570	West	250	7¾	5100
32		5	*E*	—	79	58	21	680	West	260	7¾	5400
33		4	*E*	—	79	58	21	980	West	260	7¾	5400
34[a]		8	*C*	0°	76	95	19	600	West	315	9	7100
35[a]		8	*F*	10° Down	75	97	22	520	West	270	7¾	7200
36[a]		8	*C*	0°	75	103	28	440	West	225	6½	7500
37[a]		8	*C*	0°	75	143	68	220	West	105	3	7800
38[a]		8	*F*	10° Down	74	97	23	510	West	265	7¾	7700
39		8	*C*	0°	84	84	0	580	West	315	9	0
40		8	*G*	—	75	57	18	430	West	230	6½	4200
41	Deep Vane	8	*G*	—	75	55	20	430	East	230	6½	4200
42[a]		8	*G*	—	75	103	28	470	East	230	6½	7500
43[a]		8	*G*	—	75	104	29	470	West	230	6½	8000

[a]Winter Heating Tests.
[b]Width of Outlet 14 in.
[c]See Fig. 10 for description of vertical vane settings and Fig. 1 for supply outlet and return intake locations.

Nos. 1-5 of Table 1 was to gain familiarity with the operation of the test plant and to develop a procedure for conducting the tests and compiling the data. The objective of Nos. 6-15 was to determine the effect of varying the outlet velocity and the return intake location. The desired velocity variation was accomplished by varying the size of the free opening. Note that for these tests the room temperature, supply-air temperature, flow rate, and cooling load were essentially constant. If the relatively small change in aspect ratio of the opening is ignored, the only variable in Nos. 6, 8, 11, 12, and 15 is the velocity, the return intake location being fixed at the east wall position. The results of these five tests were compared to evaluate the effect of velocity on the air distribution. The same applies to Nos. 7, 9, 10, 13, and 14, which were conducted with the return intake located in the west wall. The effect of the intake location was then evaluated by comparing the results of No. 6 with No. 7, No. 8 with No. 9, and so on.

The results with velocity as the only variable showed that an increase in outlet velocity caused the room air motion to increase and the temperature variations in the occupied zone (floor to 6 ft above floor level) to decrease. Therefore, with low outlet velocities, the problem is primarily that of a low velocity stream of cold air dropping into the occupied zone. At high outlet velocities, the problem is primarily that of high velocity currents of air at about room temperature existing in one or more regions of the occupied zone. This indicates there is an optimum value of outlet velocity at which temperature variations will be small and room air motion not excessive. For these studies with free openings, such an optimum velocity appeared to be of the order of 800 fpm.

The results with the location of the return intake as the only variable showed that the return intakes had only a very localized effect on the air distribution. Low velocity air currents within about 1 ft of the intake were drawn into it; air currents farther away than this were unaffected except in the region of the room below the 4-in. level. In this region near the floor surface, the east return caused a gentle flow of air eastward, whereas the west return caused a gentle flow westward. In both cases, the scalar magnitude of the air velocity; *i.e.*, the speed, was about the same at corresponding points in the region; hence, in this region the effect of the returns was only to change the direction of the velocity. Therefore, the location of the return intakes had negligible effect on the air distribution in the test room.

The general pattern of the air distribution was the same for all of tests Nos. 6-15. The horizontal spread of the jet was about 20 deg throughout its travel along the length of the room. With the highest outlet velocity, the lower edge of the jet entered the occupied zone at a point about three fourths of the room length or about 13 ft from the supply outlet; with the lowest velocity, it entered the occupied zone at about the center of the room or 9 ft from the outlet. The upper edge of the jet remained close to the ceiling at least until it reached the middle of the room. As the jet velocity decreased with distance from the outlet, the gravitational forces due to temperature differences between the jet air and the room air became predominant, with the result that the jet axis curved downward and into the occupied zone. For all tests, even those with an outlet velocity as low as 390 fpm, at least the upper portion of the jet struck the east wall; *i.e.* overblow occurred, indicating that the jet induced a relatively small quantity of room air.

Except in the regions where the jet entered the occupied zone, temperature variations from the control temperature were extremely small, seldom being greater than 1 deg. Consequently, vertical temperature variations in the occupied zone, which are often large in winter heating applications, do not appear to be a problem during summer cooling.

For the first two tests conducted in 1951, Nos. 16 and 17 in Table 1, conditions duplicating those of Nos. 14 and 15 were used. The results showed that the temperatures and velocities at the various points in the room were in good agreement with the 1941 tests, indicating that test conditions and data could be duplicated.

The isothermal studies, Nos. 18 and 19, showed characteristics, except for drop, very similar to those of the cooling tests, Nos. 16 and 17, in which a 15 deg differential was used. This suggests the possibility that data on the performance of various types of supply outlets obtained by other investigators, notably by those at Case Institute of Technology,

can be extended to summer cooling applications utilizing small temperature differentials.

Tests Nos. 20 and 21 were special studies conducted to determine the effect of imposing various proportions of the total cooling load on different room surfaces. During No. 20 about 85 percent of the load was applied on the exposed walls and none through the floor, whereas in No. 21 about 60 percent was applied through the floor of the room by heating the basement space. The results of these studies were compared with No. 16, in which 56 percent of the load was applied through the ceiling.

The jet axis in No. 16 remained in a vertical plane perpendicular to the east wall, whereas in No. 20 the jet did not drop as much and the jet axis curved toward the south wall. For No. 21, the jet dropped even less, the flow patterns in the room were significantly different, and the jet axis curved even more toward the south wall. These effects were apparently due to free convection currents along the room surfaces. The higher north corridor temperature of 138 F in No. 20, as compared to 103 F in No. 16, set up stronger free convection currents in a clockwise circulation (looking from the supply outlet) about the room. Since the jet initially issues from an opening near the ceiling, the free convection currents moving along the ceiling surface in a north to south direction tend to push the jet toward the south wall. When the average basement temperature was 134 F and the north corridor temperature 108 F (No. 21), the free convection currents were apparently even stronger than during No. 20, because the jet moved still farther toward the south wall. This signifies that free convection effects at the various surfaces of a room can have definite influence on the air distribution.

The results of these studies indicate that free openings of the sizes tested are unsatisfactory for summer cooling installations, principally because of the small amount of induction and the lack of control over the jet with subsequent overblow and excessive drop.

Vaned Outlets — Results and Conclusions

The studies made with vaned outlets are presented in Table 2. Of those listed, 14 are summer cooling and 7 are winter heating studies, and one is an isothermal exploration. The studies encompass two types of vaned outlets, seven vertical and four horizontal vane settings, two different supply-air temperatures for cooling and four for heating, two return intake locations, and four rates of flow.

The vertical vane settings in the fourth column of the table are described in Fig. 10. The vanes of the commercial supply outlets used with settings *A*, *B*, *C*, *D*, and *F* could be adjusted to any desired angle in groups of 6 or 7 vanes; whereas those of setting *E* were fixed at 22 deg right and left deflections. The vanes of the deep-vane outlet, setting *G*, could be individually adjusted. Where horizontal settings are not given in the fifth column of Table 2, the supply outlet was not equipped with horizontal vanes; *i.e.*, it was a single-deflection type. The location of all supply outlets is shown in Figs. 1 and 7b.

A study of the effect of the return intake location during summer cooling conditions (Tests Nos. 22-25, 40, and 41) showed, as with the free openings, that the intake location had negligible effect on the air distribution in the room. Tests Nos. 42 and 43, which were conducted under winter heating conditions and with the return intake location as the only variable, showed the same trend. However, the results of these two tests alone are not considered sufficient to substantiate a definite conclusion that the intake had negligible effect on the air distribution during winter heating. All of these tests showed that the particular vane setting of an outlet had great influence on the air distribution whereas the vane depth did not. The remaining 14 tests were therefore limited to one return intake location and one outlet type.

In studying the effect of both the horizontal and vertical vane settings on the air distribution, velocity and

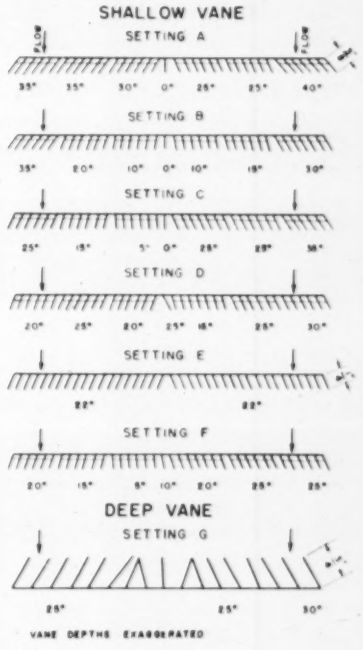

Fig. 10—Description of vertical vane settings

temperature probes were conducted in the room prior to each test and the vanes of the supply outlet adjusted until the air distribution reached an apparent optimum. Vertical vane setting *A* was the first one used, Test 22, and was a result of attempts to prevent excessive drop of the jet by increasing the spread. Although this setting eliminated the problem of drop, the supply air was split into two distinct jets which impinged on the adjacent walls at points about 45 deg from the outlet, one jet striking the north wall and one the south wall. A stream of air then flowed eastward along each of these walls and to the center of the east wall; here the two streams met and formed one stream that traveled up the center of the room in the direction of the supply outlet. The result was a general movement of air in a clockwise direction, looking from above, in the north half of the room and a counterclockwise movement in the south half.

In order to eliminate the undesirable impingement on the adjacent walls, further experimentation with the vanes was conducted, the result

being setting *B*. This setting also produced two jets. However, the jet in the direction of the north wall turned away from the wall and back toward the center of the room; the jet in the direction of the south wall hit that wall and continued along it. As a consequence, a counterclockwise movement of the air was set up throughout the room.

Further explorations led to setting *C*, which directed more air toward the north wall. In contrast to the effect of setting *B*, a clockwise movement of air throughout the room resulted with setting *C*. Since the air distribution in the room was significantly different for each of the three vane settings, the vertical vane setting of a high sidewall supply outlet is evidently an extremely important factor affecting the air distribution in a room during cooling.

The most uniform temperatures and velocities in the occupied zone during cooling were obtained with vertical vane setting *C* and a 19 deg upward deflection of the air with horizontal vanes located behind the vertical vanes (Test No. 28). This test was conducted with a 15 deg temperature differential. When a 20 deg differential was used, excessive drop occurred and further experimentation with the vertical and horizontal vane settings was required. Although vertical vane setting *D* was eventually selected and Test No. 29 conducted, no combination of settings of the horizontal and vertical vanes was found which completely prevented cold air from entering the occupied zone. This indicates that, when conventional high sidewall supply outlets are used in residences, air distribution problems can be expected to become increasingly difficult as the supply-air temperature is decreased below that corresponding to a 15 deg differential.

The objective of Nos. 30-33, which were summer cooling tests, was to study the effect of outlet velocity. As in the case of free openings, the room air motion increased as the outlet velocity increased. In addition, air noise at the outlet was clearly audible at the outlet velocity conditions of 680 and 980 fpm in Nos. 32 and 33. Instead of the single jet expected with these conventional 22 deg right and left deflection outlets, setting *E*, Fig. 10, two jets were produced. This two-jet condition was not evident by a velocity traverse taken within about 1 in. of the outlet, since such traverses always indicated a uniform velocity across the outlet face. However, within a very few inches of the face, the air issuing from about the center half of the outlet split into two streams, one of which was deflected sharply to the right and the other sharply to the left. These streams joined the air issuing from the two outside portions of the outlet and formed two distinct jets. Moreover, the included angles of the axes of the two jets was *greater* than the 44 deg included angle of the vane settings, which is in contradiction with information available in current technical literature.[5] These effects are believed to be caused by the existence of a pressure gradient in the jet close to the outlet; further analytical and experimental work on these effects is contemplated.

It would be expected that a low-pressure region would exist close to the supply outlet and between the two jets, and that room air would be drawn into this region. Explorations showed that such was the case. Along an axis through the center of the outlet, and normal to the outlet face, room air flowed directly toward the supply outlet and to within about three inches of the face before being induced by one of the jets and carried away.

These effects: the two jets, their greater than expected included angle, and the flow of room air to within a few inches of the outlet face are not peculiar characteristics of the test plant. The same effects were observed in two research residences being operated under summer cooling conditions representative of usual residential practice.

The primary purpose of the winter heating studies was to determine whether the relatively high flow rates employed during cooling could be utilized successfully during winter heating. Tests Nos. 34 and 36 were therefore conducted with the cooling flow rates of 310 and 225 cfm. The results were compared with those of a test, No. 37, utilizing only 105 cfm, which is representative of current heating practice for such a room.

For all of the heating tests of Table 2, gravitational forces due to the difference in densities of the supply air and room air were found to be extremely important. In each case the jet immediately rose toward the ceiling and practically all of the induction and air motion took place above the occupied zone; consequently, the air velocities in the occupied zone were generally very low. With the highest flow rate of 315 cfm, the velocities at numerous points in the occupied zone were only about 30 fpm; with the lowest flow rate of 105 cfm, they were of the order of 15 fpm. When smoke studies were made in the room during the 105 cfm test, a thin cloud of smoke remained practically stationary in a region at the 60-in. level. With the 230 cfm tests, this same sort of stagnation region existed at the 30 in. level. The minimum flow rate at which a stagnation region did not occur was found to be 270 cfm; Test 35 was therefore conducted with this flow rate. During exploratory studies and Tests Nos. 35 and 38, attempts to increase the air motion, and thereby reduce vertical temperature variations in the occupied zone, by directing the supply-air downward at various angles were unsuccessful. Although a horizontal vane setting such as 10 deg down would initially direct the jet toward the floor, within a very few feet of travel from the outlet it would rise above the occupied zone. In fact, it was as difficult to get the warm supply-air down into the occupied zone during heating as it was to prevent the cool supply air from dropping into the occupied zone during cooling.

During Test No. 37, with a flow rate of 105 cfm and a corresponding supply air temperature of 143 F, the average vertical temperature variation between the 4-in. and 78 in. levels in the room was 23 F. Increasing the flow rate to 225 and then 315 cfm (Tests Nos. 36 and

34), reduced the variations to 17 and 11 F deg, respectively, (the supply-air temperature was 103 F during No. 36 and 95 F during No. 34). Thus, high rates of flow during winter heating are advantageous in reducing temperature variations in a room. Moreover, comparison of the heating loads given in Table 1 for these three tests shows that the load decreases as the supply-air temperature decreases. This is attributed to the lower temperatures existing in the upper portions of the room with the smaller temperature variations. This effect on heating loads has been reported by other investigators.[6] These favorable characteristics of high flow rates; namely, reduction of temperature variations and a decrease in heating load, together with the fact that the room air motion was not excessive even at a flow rate as high as 315 cfm, indicates excellent possibilities of year 'round air conditioning systems successfully utilizing the same flow rate during both winter heating and summer cooling.

The conditions of a special heating test, No. 38, were similar to those of No. 35 except that the temperature of the basement space was maintained at 46 F during the former and at 75 F during the latter. As a consequence, the floor surface temperature during No. 38 was correspondingly lower than during No. 35. With the simulated *crawl-space* condition of 46 F, the previously described stagnation region existed in the 30 in. level, whereas no such stagnation region existed in the test room with the simulated *heated-basement* condition of 75 F. This indicates that air distribution problems can be expected to become more difficult as the temperature of the space beneath the floor of a room is lowered, with consequent lowering of the floor surface temperature.

Summary of Results and Conclusions

1. The free openings were unsatisfactory as high sidewall supply outlets for summer cooling.

2. During the summer cooling studies, the location of the return intake had only a localized effect on the air distribution when both free openings and vaned outlets were used. The same trend was found during the limited number of winter heating studies conducted.

3. At the same outlet velocity, the air motion in the occupied zone was much greater during the cooling studies than during the heating studies.

4. Vertical temperature variations in the occupied zone during cooling were generally about 1 deg, whereas they ranged between 10 and 20 deg during heating.

5. The vertical-vane settings of the supply outlets had a great influence on the air distribution in the occupied zone during cooling, but only a small influence during heating.

6. The horizontal-vane settings of the supply outlets affected the air distribution in the occupied zone during cooling, but did not affect it during heating.

7. Gravitational forces due to the difference in the densities of the supply air and the room air had an extremely important effect on the air distribution during both cooling and heating.

8. An increase in the flow rate during winter heating, with accompanying decrease in supply-air temperature, caused a decrease in the temperature variations within the room and a reduction of the room heat loss, but did not cause excessive air motion in the occupied zone. This indicates excellent possibilities of year 'round air conditioning systems successfully utilizing the same flow rate during both winter heating and summer cooling.

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Compression Tank Selection for Hot Water Heating Systems

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SUMMARY — The purpose of this paper is to simplify the procedure for selecting the size of compression tank for forced circulation hot water heating systems. Average values have been obtained for the water content of boilers, radiators, convectors, and piping and panels for panel heating systems.

A table has been included to facilitate tank selection for conditions adopted as standard. Correction factors for conditions other than standard are included in the selection table. Equations for determining proper tank capacities for various conditions are developed.

CURRENTLY ACCEPTED methods for sizing compression tanks give widely divergent results. For instance, on a specific single story heating system, the size of compression tank installed could be 11 gal, by a formula in HEATING, VENTILATING, AIR CONDITIONING GUIDE 1952, Chapter 21 — Hot Water Heating Systems, or 35 gal by *ASME* Code requirements. Other sizing methods would yield still different results. It can be stated that the size of compression tank installed today depends as much on the tank sizing method used as on the particular system.

Compression tanks are used in hot water heating systems for three reasons: (1) to allow the system to operate at temperatures above 212 F; (2) to control rate of pressure increase with temperature rise in the system; and (3) to eliminate relief valve operation, with consequent need for refilling the system with water, unless unsafe conditions occur.

In order to comply with these requirements, the tank should be of proper size.

The formula in Chapter 21 of THE GUIDE 1952, establishes a more exact tank size than the empirical methods otherwise employed, since it is based on actual water content. The simplicity of the empirical methods, however, often leads designers to use them rather than the formula in THE GUIDE 1952 which requires more work in determination of system water content.

It is the purpose of this paper to present a safe and rational compression tank sizing method which will be basically as simple as the present empirical methods. Table 1 shows a tank selection chart prepared for this purpose.

The upper section of Table 1 shows the maximum tank size required separately for the boilers, radiation, forced circulation piping, and for piping and panels in a panel heating system. The maximum tank size for a complete system is found by adding the maximum tank capacities required for each component of the system. Maximum tank capacity requirements are based on 22 percent of the average water contents of boilers, radiation and piping, and adopted standard conditions of 12 psig initial pressure, 30 psig final pressure and 18.5 ft maximum system height above the tank.

The lower section of Table 1 lists correction factors by which the maximum tank capacities are to be multiplied to obtain either maximum or minimum tank capacities for conditions other than standard.

The volume data for boilers, radiation and piping, and the operating conditions adopted as standard, as well as the basis for correction factors for conditions other than standard, are presented in Appendix A.

The majority of hot water heating systems today are installed with the tank in the basement, with an initial fill pressure of 12 psig, and with a final relief valve pressure of 30 psig. In this paper, the maximum temperature at which relief pressure is reached is assumed to be 262 F, the minimum relieving temperature being 220 F. A 4-psig fill pressure is established as minimum at the top of the system and the maximum system height for standard conditions is 18.5 ft.

A rational estimate of compression tank volume requirements indicates that the tank should be sized between 16 and 22 percent of the total system volume under standard conditions. Table 1 is based on 22 percent of the volume of any given component of the heating system. The *maximum tank size* for any system is determined by adding the tank requirement of each component; piping, radiation, and boiler. The *minimum tank size* is determined by multiplying maximum tank size by 0.73.

Table 1 establishes the minimum tank size at a condition such that relief pressure is reached at 220 F. For systems utilizing a design temperature higher than 220 F the minimum tank size established by the table cannot be used. Either the maximum tabulated tank size alone should be used or minimum tank size should be established by an equation given later in this paper in the section, Formulas for Determining Tank Size.

The *effective size* of a given compression tank is determined by the relation of the volume of air within the tank, under initial fill pressure or cold non-operating conditions, to the volume of water expansion it is expected to absorb. A lowering of the initial fill pressure increases the air volume and hence increases effective tank size. An increase of initial fill pressure, as caused by a high static head system, decreases effective tank size. In order to re-

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Table 1. Proposed Method for Selecting Proper Size of Expansion Tank.

Maximum Tank Size Required For Boiler (Under Standard Conditions)*				
Net Btu Rating in 1000 Btuh	Conventional		Flash	
	Gals in Boiler	Tank Req'd.	Gals in Boiler	Tank Req'd.
50	12	2.64	5.4	1.19
60	14.5	3.19	6.4	1.41
70	17	3.74	7.2	1.58
80	19.5	4.29	8.0	1.76
90	22	4.9	8.6	1.89
100	25	5.5	9.4	2.07
125	30	6.6	11	2.42
150	36	7.9	13	2.86
175	42	9.24	14.5	3.19
200	48	10.6	16	3.52
250	60	13.1		
300	70	15.4		
350	84	18.4		
400	95	20.9		
450	107	23.5		
500	120	26.4		
600	140	30.8		
700	160	35.2		
800	190	41.8		
900	210	46		
1000	235	51.7		
2000	480	106		
3000	720	158		
4000	960	211		
8000	1200	264		
12000	3000	660		
16000	3700	814		

Maximum Tank Size Required For Radiation (Under Standard Conditions)*									
Rad. Output in 1000 Btuh at 200 Btuh Emission	Large Tube		Thin Tube		Convector		Base Board		
	Gals in Rad.	Tank Req'd.	Gals in Rad.	Tank Req'd.	Gals in Rad.	Tank Req'd	Gals in Rad.	Tank Req'd.	
50	28.5	6.27	15.7	5.4	7	1.5	3.2	0.704	
60	34.2	7.52	16.8	5.7	7.5	1.65	4.0	0.880	
70	40	8.8	19.6	4.5	8.7	1.93	4.5	0.990	
80	43.6	10	22.4	4.9	10	2.2	5.2	1.14	
90	51.4	11.3	25.2	5.5	11.25	2.48	5.8	1.27	
100	57	12.5	28	6.2	12.5	2.75	6.5	1.43	
125	71	15.6	39	8.58	17.7	3.89	8.1	1.78	
150	85.5	18.8	47.8	10.5	21	4.62	9.7	2.13	
175	99	21.7	55	12.1	24.7	5.43	11.5	2.48	
200	114	25.8	63.8	14.1	28.5	6.27	13	2.86	
250	142	31.2	79.8	17.5	35.6	7.85	16.2	3.56	
300	171	37.6	95.7	21.0	42.7	9.39	19.5	4.29	
350	199	43.7	111	24.4	49.7	10.9	22.7	4.99	
400	228	50.1	127	27.9	57	12.5	26	5.72	
450	256	56.1	145	31.4	64	14	29.2	6.42	
500	285	62.7	157	34.5	71	15.6	32.5	7.15	
600	342	75.2	191	42	85.5	18.8	39	8.58	
700	399	87.7	223	49	98.7	21.7	45.5	10	
800	456	100	251	55.2	114	25	52	11.4	
900	513	112	287	63.1	128	28.1	58.5	12.8	
1000	570	125	319	70.1	142	31.2	65	14.3	
2000	1140	250	638	140	285	62.7	130	28.6	
3000	1710	376	957	210	427	93.9	195	42.5	
4000	2280	501	1276	280	560	123	260	57.2	
8000	4560	1003	2553	561	1140	250	520	114	
12000	6840	1504	5830	852	1710	376	780	171	
16000	9120	2006	5107	1123	2280	501	1040	228	
20000	11400	2508	6384	1407	2850	627	1300	286	

Maximum Tank Size Required for Forced Circulation Piping (Under Standard Conditions)*				
Heat Conveyed in 1000 Btuh	One Pipe		Two Pipe	
	Gals in Piping	Tank Req'd.	Gals in Piping	Tank Req'd.
50	7.8	1.7	10.5	2.3
60	9.0	1.98	12.5	2.75
70	10.0	2.2	14.5	3.2
80	11.5	2.5	17	3.7
90	13	2.9	18	3.96
100	14	3.1	21	4.6
125	18	3.96	27	5.9
150	22	4.85	34	7.5
175	26	5.7	40	8.8
200	30	6.6	47	10.3
250	39	8.6	62	13.6
300	49	10.8	78	17.2
350	58	12.8	94	20.7
400	70	15.4	110	24.2
450	80	17.6	130	28.6
500	90	19.8	150	33
600	115	25.3	190	41.8
700	140	30.8	225	49.5
800	165	36.3	260	57.2
900	195	42.9	310	68.2
1000	225	49.5	360	79.2
2000	540	119	900	198
3000	960	211	1800	330
4000	1350	297	2100	462
8000	3400	748	5000	1100
12000	5000	1254	9000	1980
16000	8500	1826	13000	2860

Maximum Tank Size Req'd For Panel (Under Std. Conditions)*		
System Btu in 1000 Btuh	Panel	
	Gals in Panel	Tank Req'd
50	11	0.8
60	15.5	1.0
70	16	1.2
80	18.5	1.35
90	21	1.55
100	24	1.75
125	30	2.2
150	37	2.7
175	44	3.2
200	50	3.7
250	65	4.75
300	70	5.7

Note:
For minimum tank size under standard conditions multiply Value obtained from table by 0.73

Correction Factors For Initial Pressures Other Than 12 Psig (4 Psig Min. Pressure Highest Part of System, 30 Psig Relief Pressure)				
Initial Pressure	Static Height	Max. Mean Temp. at Max. Mult. Factor	Multiplying Factor Maximum	Multiplying Factor Minimum
4	0	264	0.465	0.3
6	4.5	260	0.575	0.38
8	9	257	0.7	0.48
10	14	255	0.85	0.59
12	18.5	252	1.0	0.73
14	23	250	1.19	0.9
16	27.5	245	1.43	1.1
18	32	242	1.74	1.41
20	36.5	237	2.18	1.82
22	41.5	235	2.82	2.5
24	46	227	3.82	3.5

Correction Factors For Attic Tanks (4 Psig Initial Pressure on Tank Press., Rise = Final Press. Static 4 Psig			
Pressure Rise	Max. Mean Temp. at Max. Mult. Factor	Multiplying Factor Maximum	Multiplying Factor Minimum
4	222	1.27	1.25
8	235	0.77	0.68
10	238	0.68	0.57
12	242	0.65	0.50
14	246	0.59	0.45
16	249	0.55	0.41
18	252	0.53	0.38
20	255	0.51	0.36
25	261	0.48	0.315
30	267	0.465	0.28
35	271	0.45	0.26

Correction Factors For Systems Using Compressor to Charge Tank (Comp. Tank 80% Full of Air After Charging with Compressor)					
Static Height	Initial Pressure	Relief Pressure	Max. Mean Temp. at Max. Mult. Factor	Multiplying Factor Maximum	Multiplying Factor Minimum
10	8.5	30	256	0.55	0.35
18.5	12	30	252	0.65	0.48
25	15	30	248	0.85	0.67
30	17	30	244	0.97	0.79
40	21.5	45	255	0.71	0.47
50	26	45	251	0.815	0.59
60	30	45	248	1.04	0.82
75	37	75	264	0.68	0.78
100	47	75	264	0.97	0.62
150	65	100			

Correction Factors For Safety Loop Systems			
Initial Pressure	Max. Mean Temp. at Max. Mult. Fact	Mult. Factor Max.	Mult. Factor Min.
4	262	0.72	0.46
6	262	0.98	0.56
8	262	1.24	0.74
10	262	2.16	1.0
12	262	5.5	1.5

Correction Factors For Tanks that are Already Undersized		
If Tank Reaches Final Press. At Temp.	Req'd. Tank Size Increase For Final Press. at 220F	
		One in-d Tan Vo
170	2.1	×
180	1.87	×
190	1.63	×
200	1.34	×
210	1.24	×
220	1.13	×

*Standard conditions are: 12 psig initial pressure, 30 psig final pressure, static pressure up to 18.5 ft.

duce tank size, it may be necessary to install the tank at the highest point of a high static head system or lower the initial fill pressure below standard on a low static head system.

The following *Examples 1 to 6* will illustrate the method of selecting tank sizes by use of Table 1:

Example 1: Select the size of compression tank for standard conditions for a hot water heating system having: 100,000 Btuh conventional boiler; 90,000 Btuh thin-tube radiation @ 200 Btuh emission = 450 sq ft (water radiation); 90,000 Btuh one-pipe system; 5 ft static head; 12 psig initial fill pressure; 30 psig final pressure; and tank located at boiler.

Solution:

(*a*) Establish maximum tank size from Table 1:

100,000 Btuh conventional boiler requires	5.5 gal
90,000 Btuh thin tube requires	5.5
90,000 Btuh one-pipe system requires	2.9
Maximum tank size	13.9 gal

(*b*) Establish minimum tank size:

13.9 gal × 0.73 = 10.1 gal.

(*c*) Tank selection will be made between 10.1 and 13.9 gal. A 12-gal tank is therefore selected.

Example 2: For the conditions of *Example 1*, determine the smallest tank that can be used by lowering the initial pressure.

Solution:

(*a*) Establish lowest possible initial pressure. From Table 1 for initial pressure other than 12 psig, it is seen that 8 psig can be used for a static head of 5 ft.

(*b*) The maximum and minimum correction factors at 8 psig initial pressure are: for maximum tank size correction factor = 0.7; for minimum tank size correction factor = 0.48.

(*c*) The maximum and minimum tank sizes will then be:

maximum = 13.9 × 0.7 = 9.75 gal,
minimum = 13.9 × 0.48 = 6.7 gal.

(*d*) An 8 gal tank will be selected, since it is between 6.7 and 9.75 gal.

Example 3: Select a compression tank for the system in *Example 1* if the system height is changed to 30 ft.

Solution:

(*a*) From Table 1 it is found that an initial pressure of 18 psig can be used at static heights up to 32 ft.

(*b*) From Table 1, the correction factors at 18 psig are:

for maximum tank size, 1.74;
for minimum tank size, 1.41.

(*c*) Maximum and minimum tank sizes will be:

maximum tank size = 13.9 × 1.74 = 24.2

minimum tank size = 13.9 × 1.41 = 19.6

(d) A 24 gal tank is selected, as it has a capacity between 19.6 and 24.2.

Example 4: For the same conditions as *Example 3*, determine tank size if the tank is placed in the attic.

Solution:

(a) Establish the pressure rise. The initial pressure at boiler = 13 psig + 4 psig = 17 psig. Then the pressure rise = 30 psig (final pressure) — 17 psig = 13 psig.

(b) From the correction table for attic tanks in Table 1, a pressure rise of 13 psig corresponds, by interpolation, to:

a maximum tank size correction factor = approx. 0.61,

a minimum tank size correction factor = approx. 0.475.

(c) The tank size is determined as:

maximum tank size = 13.9 × 0.61 = 8.5 gal,

minimum tank size = 13.9 × 0.475 = 6.6 gal.

(d) An 8 gal tank is selected as its capacity is between 8.5 and 6.6 gal.

Example 5: Select a compression tank for the same system as described in *Example 4* except that the tank is to be installed in the basement, the static head is 60 ft, and an air compressor will be used to charge the tank with air.

Solution:

(a) From the correction table for air compressor charged tanks, a static height of 60 ft requires an initial pressure on the system of 30 psig and a final pressure of 45 psig.

(b) Correction factors are then:

maximum tank size correction factor = 1.04,

minimum tank size correction factor = 0.82.

(c) Tank sizes will then be:

maximum tank size = 13.9 x 1.04 = 14.5

minimum tank size = 13.9 x 0.82 = 10.4

(d) A tank sized at 12 gal is selected. It will be noted that this tank is very much smaller than the 60 gal tank otherwise required for a basement tank under the conditions outlined.

Example 6: Select a compression tank for a panel or radiant heating system under the following conditions: 120,000 Btuh flash type boiler; 100,000 Btuh panel output; 12 psig initial pressure; 30 psig final pressure; 5 ft static head.

Solution: 12 psig initial, 30 psig final pressure and 5 ft static head will allow use of Table 1 without correction.

(a) From Table 1 the boiler and panel system capacities are:

120,000 Btuh flash boiler = 2.35 gal

100,000 Btuh panel system = 1.75

The maximum tank size = 4.1 gal

The minimum tank size = 4.1 x 0.73 = 3.0 gal.

(b) Assume that a tank between 3.0 and 4.1 gal is not available and that the next tank size is 8 gal. The requirement at 4.1 must be multiplied by 1.95 to equal 8 gal. From Table 1 the initial pressure correction factor of 1.95 corresponds to 19 psig initial pressure.

The tank would then be sized at 8 gal with an initial pressure of 19 psig.

Formulas for Determining Tank Size

In order to simplify the paper, most of the analysis and other details necessary to develop the formulas are presented in the Appendix B.

Factors which may affect selection of compression tank size are as follows:

1. Pressure volume or isothermal relationship of tank to system expansion.
2. Temperature changes of air within the tank as this affects pressure volume relationship.
3. Expansion of water in system.
4. Expansion of water in compression tank.
5. Expansion of piping, boiler and radiation of system.
6. Expansion of compression tank.
7. Liberation of air trapped in system water when heated.
8. The effect of trapping additional air in the compression tank during the filling of the system.
9. Loss of air from the compression tank.

If all factors involved are considered without evaluation, the general formula for determining compression tank size is

$$V_t = \frac{(E_w - E_p)V_s}{\frac{p_a}{p_f} - \frac{p_a}{p_o}} - 0.02V_s \qquad (1)$$

The symbols in Equation 1 are defined in the Nomenclature.

Equation 1 is rather complex, and is not necessary for the selection of a compression tank for the average system (not including the safety loop system) for which the following equation is satisfactory:

$$V_t = \frac{(E_w - E_p)V_s}{\frac{p_a}{p_f} - \frac{p_a}{p_o}} - 0.02V_s \qquad (2)$$

Equation 2 is the result of dropping many of the factors of small importance from Equation 1.

Limiting factors which cannot be shown in the equation will be discussed in a later section of the paper.

It is of interest to note the similarity between Equation 2 and the formula given on p. 525 of THE GUIDE 1952.

The boundary limits for compression tank sizing are:

1. (*Upper*) Boiling must not occur in any part of the system at any temperature-pressure relationship in the design range.
2. (*Lower*) Relief valve operation should not occur at temperatures in the design range.

The lower boundary limit can be evaluated from Equation 2 by sub-

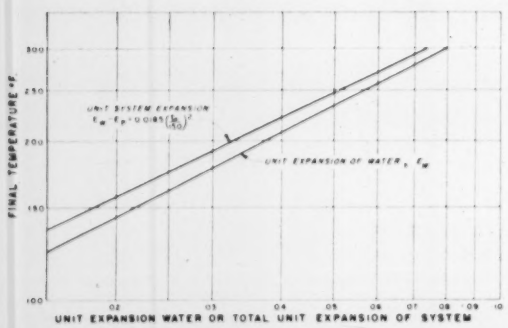


Fig. 1—Unit expansion of water or total unit expansion of system (initial temperature 40 F)

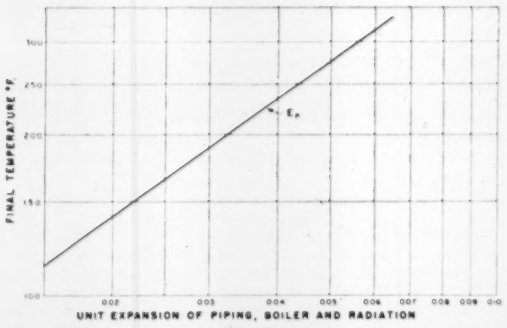


Fig. 2—Unit expansion of piping, boiler and radiation (initial temperature 40 F)

stituting values of E_w and E_p corresponding to the filling and operating temperatures, respectively in Equation 2.

The reference temperature, from which expansion of the system will be taken, is established at 40 F. It is recognized that in some systems the reference or fill temperature may be higher than that established, but minor changes at the lower temperature level will not affect the final result appreciably.

Unit expansion of water (E_w) has been determined from the relationship

$$E_w = (V_t\ @\ t_o)/(V_t\ @\ 40\ \text{F}) - 1$$

Results are plotted in Fig. 1.

The unit expansion of pipe (E_p) has been determined from the relationship $E_p = 3\alpha/\text{F}$, where $\alpha = 6.85 \times 10^{-6}$, the coefficient of expansion for wrought iron. Results are plotted in Fig. 2.

The two curves thus established have been combined in a final curve of $E_w - E_p$, also plotted in Fig. 1. From this curve the following formula was developed to express unit system expansion in terms of mean system temperature:

$$E_w - E_p = [0.0185\ (t_o/150)^2] \quad \ldots (3)$$

The upper boundary limit is concerned with boiling in the system. It may be evaluated from Equation 2 by substituting values of E_w and E_p corresponding to the temperature and pressure existing at the point of lowest pressure (the highest point) in the system.

Fig. 3, a log-log plot of boiling temperature *vs.* pressure, indicates the temperature-pressure relationship which must not be exceeded. Parallel to a line passing through the 10 psig and 30 psig points and at a temperature 10 deg lower than the values given in the steam tables, a straight line curve has been established. This curve will be used as the upper mean temperature-pressure relationship which must not be exceeded.

It is based on accepted 20 deg temperature drop design practice; the maximum temperature reached in the system is 10 deg above the mean temperature upon which calculations must be based.

Nomenclature

- p_a = atmospheric pressure, pounds per square inch, absolute.
- p_f = initial fill pressure; pressure in tank under non-operating conditions, pounds per square inch, absolute.
- p_o = final pressure; pressure in tank when operating, pounds per square inch, absolute.
- p_s = additional pressure in tank over atmospheric, when water starts to enter during fill operation, pounds per square inch, gage.
- p_{tl} = limiting pressure existing at the highest point of the system under operating conditions, pounds per square inch, gage.
- V_t = expansion tank size, gallons.
- V_s = volume of system; boiler piping and radiation, gallons.
- T_a = air temperature in tank before fill, Fahrenheit, absolute.
- T_f = air temperature in tank after fill, Fahrenheit, absolute.
- T_o = air temperature in tank during operation, Fahrenheit, absolute.
- t_o = mean water temperature in system during operation, (or temperature −10 deg) required for boiling at limiting pressure p_{tl}, Fahrenheit.
- E_w = unit expansion of water.
- E_p = unit expansion of piping, radiation and boiler.
- E_t = unit expansion of compression tank.
- E_{wt} = unit expansion of water contained in compression tank.
- V_f = specific volume of saturated liquid.
- α = coefficient of expansion.

It will be noted that as higher pressure and temperature relationships are reached, the mean temperature deviates more and more from the actual boiling conditions. For the purpose of this paper, the upper limit of usefulness of the curve is 275 F. The curve can be represented by the equation:

$$t_o = 170\ p_{tl}^{0.120}$$

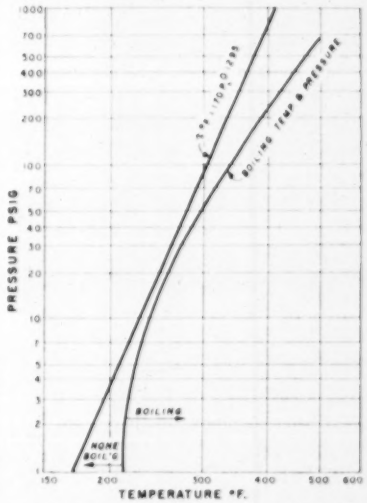


Fig. 3—Temperature-pressure relationship for boiling water

For high temperature systems a new curve must be established.

Substituting for t_o in Equation 3, yields

$$E_w - E_p = 0.0236\ p_{tl}^{0.238} \quad \ldots\ldots (4)$$

Equation 4 expresses unit system expansion in terms of a limiting pressure related to a temperature which is 10 deg below the boiling point of water at that limiting pressure.

Substituting values of $E_w - E_p$ from Equations 3 and 4 in Equation 2, two new equations are obtained to express the boundary limitations existing for sizing of compression tanks.

$$V_{t,max} = \frac{0.0236\,p_{tl}^{0.238} V_s}{\frac{p_a}{p_f} - \frac{p_a}{p_o}} - 0.02V_s \quad \ldots\ldots (5)$$

$$V_{t,min} = \frac{0.0185\left(\frac{t_o}{150}\right)^2 V_s}{\frac{p_a}{p_f} - \frac{p_a}{p_o}} - 0.02V_s \quad \ldots\ldots (6)$$

A limitation of these two equations which does not appear as a term is the condition that air must not escape from the tank if water logging of the tank is to be avoided.

In Equation 5 the term $V_{t\,max}$ is the compression tank size required under maximum temperature-pressure conditions.

In Equation 6 the term $V_{t\,min}$ is the compression tank size required

under minimum temperature-pressure conditions.

The term p_a is the pressure within the tank before water enters. Normally this pressure may be assumed as atmospheric pressure. This premise, however, is based on slow filling of the system and on venting when filling. If the system is not vented, or if the filling rate is over approximately 4 gpm (approximate automatic fill valve rate) the tank pressure will be above atmospheric before water starts to enter.

For example, at a 10 gpm filling rate, the pressure in the tank will be approximately 1 psig in a system with flash-type boiler and radiation above the main; about 3½ psig in the tank with conventional-type boiler and radiation above the main and approximately 7 psig in the tank with systems in which the boiler is above the radiation. An increase of p_a above atmospheric pressure decreases the tank size required but is difficult to control.

The term p_f in Equations 5 and 6 expresses the pressure in the tank after filling while the system is still cold. It is normally 12 psig but may be either larger or smaller, depending on the static height of the system above the tank. The minimum pressure that should be used for p_f may be considered as the static height of the system above the tank plus 4 psig, where 4 psig is the pressure required at the top of the system.

Raising p_f will increase the tank size required and vice-versa. On large systems, where a small tank is decidedly advantageous, the tank is often installed at as high a point as possible, in order to reduce p_f and, hence, the tank size.

The term p_o is the final desired operating pressure at the tank and may cover a wide range. It is normally 30 psig but may be higher or lower, depending on static height above the tank or desired operating conditions. With a given p_f, a larger p_o reduces the tank size required.

The term p_L expresses the highest pressure which may exist at the highest point of the system under desired maximum operating conditions. A higher p_L establishes a higher maximum final operating temperature and vice-versa.

For any specific system, p_L can be determined by adding the filling pressure at the highest part of the system to the desired pressure rise in the system:

$$p_L = 4 \text{ psig} + (p_o - p_f)$$

where 4 psig is minimum desired filling pressure at highest point of the system. This pressure may be set higher at the discretion of the designer.

The term t_o is the temperature at which relief pressure will occur. Equation 6 in which the term appears does not take into account the possibility of boiling and the term is used only as a lower temperature compression tank sizing limit.

The term $0.02\ V_s$ refers to the effect of additional air being brought into the tank through freeing the water of its absorbed air.

The term V_s refers to the amount of water contained in the system.

Conclusions

It has been suggested that the effect of vapor pressure within the tank, as this affects tank sizing, be examined. This will take additional time. It can be expected, however, that the effect of vapor pressure for the great majority of systems will not be of great importance since the tank temperatures are not high. For the safety loop system, the effect of vapor pressure may be more significant.

The tank sizing method developed is simple and, based on comparison with existing methods, gives a close approximation of tank requirements.

Actual test work and application data would prove of interest in determining more definitely the accuracy of results obtained from the Table 1 and from the equations.

APPENDIX A

Source of Volume Data

Fig. A-1 is drawn from data received from boiler manufacturers giving water content for specific boilers of both conventional and flash types. The water content is plotted against the net Btu rating of the boiler. As will be noted, the points fall in a fairly straight line, although there is a spread for boilers at the same rating. Average water content for the boilers has been established at the low water content side of the curve in order to insure against boiling through over-sizing the compression tank with respect to the system as might occur by basing calculations on a high water content boiler and then actually using a low water content boiler.

Fig. A-2 shows the water content for a number of heating systems; one-pipe, two-pipe and panel. Average water content is again established at the lower water content side of the curve.

Average values for radiation water content have been obtained from manufacturers with the following results:

Large tube radiation	= 0.114 gal/sq ft water radiation
Thin tube radiation	= 0.056 gal/sq ft water radiation
Convectors	= 0.025 gal/sq ft water radiation
Baseboard	= 0.013 gal/200 btuh output

Operation of Present Day Systems

The majority of hot water radiation systems are operated under the following conditions:

p_a = atmospheric pressure.
p_f = initial or fill pressure = 12 psig.
p_o = final or operating pressure = 30 psig.
p_L = limiting pressure at top of system; maximum tank sizing condition = 4 + (30 — 12) = 22 psig.
$t_{o,\max}$ = limiting temperature corresponding to 22 psig; max temperature at which system reaches relief pressure = 262 F.
$t_{o,\min}$ = lower temperature limit at which system reaches relief pressure = 220 F

These conditions are considered as standard in this paper.

By applying the conditions given to Equations 5 and 6, it appears reasonable that, under standard conditions, the compression tank should be sized between 16 and 22 percent of the total system volume.

The panel system differs from the majority of hot water heating systems in that the panel temperature rarely exceeds 140 F as a maximum temperature. Since boiling in the system need not be feared, the minimum tank size can be established by Equation 6, using a temperature t_o of 140 F and maintaining other conditions as standard. Calculations indicate that the panel system requires only 5.3 percent of the system volume for minimum compression tank size. Maintaining the same

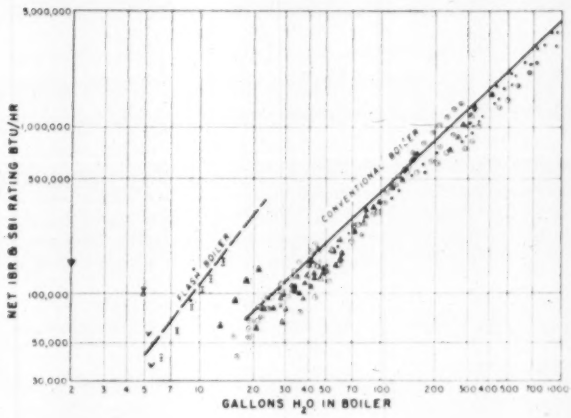


Fig. A-1—Boiler water content in gallons

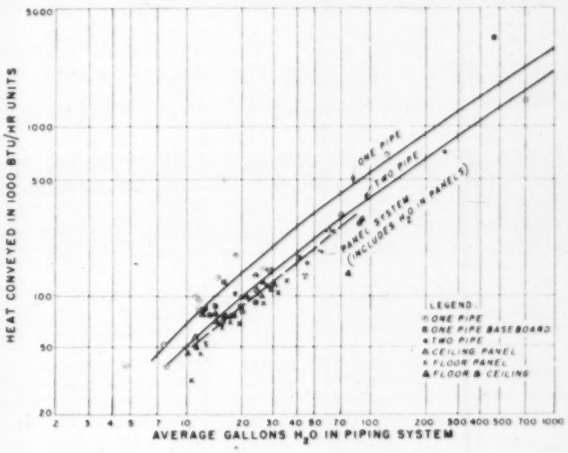


Fig. A-2—Gallons of water in piping system

maximum and minimum ratio as for the standard radiation system, the maximum tank size required would be 7.3 percent, with a corresponding maximum temperature of 160 F. Generally speaking, an all panel system does not require extremely accurate tank sizing and the limits indicated may be increased somewhat. Care should be exercised, however, for systems containing panels and radiators, and systems in which a high water content boiler is maintained at high temperature.

Basis for Correction Factors In Table 1.

When the maximum tank size required for standard conditions has been selected by reference to the upper section of Table 1, corrections may be made for conditions other than standard by referring to the correction factors in the lower section of Table 1. The conditions for which corrections may be made are given in the following items 1 to 5.

1. *Correction factors for change in initial pressure when final pressure is maintained at 30 psig.* As has been previously noted, a higher initial pressure requires a larger tank and vice-versa. Table 1 lists correction factors for various initial pressures other than 12 psig together with the maximum applicable static height of the system. The table should prove useful for high static head systems and for large low static head systems in which a reduction of tank size is desired.

2. *Correction factors for attic tanks.* In order to reduce initial tank pressure and thus reduce size, the compression tanks on many high static or very large systems are installed at the highest point of the system. Inasmuch as the relief valve setting on high static head systems is not a constant, varying from 30 psig to 160 psig + the correction table is based on pressure rise of the system from its cold to operating condition. Pressure rise is defined as final boiler pressure minus initial boiler pressure, initial boiler pressure being considered as system static head + 4 psig.

3. *Correction factors for safety loop sizing.* In a small minority of systems, in which the main is run below the top of the boiler, the compression tank is used secondarily as a heat dissipating device under runaway boiler heat input conditions. This system differs from the majority in that gravity flow to the tank is deliberately encouraged by use of a recirculating leg connected from the tank to the bottom of the boiler. The recirculating leg is in addition to the normal boiler to tank connection used on all compression tank systems. Because the temperature in the tank is higher in the safety loop system than in the average system, Equation 2 of the paper is modified as follows for the safety loop system:

$$V_t = \frac{(E_w - E_a)V_s}{\left(\frac{E_w}{E_f}\right)\left(\frac{P_a}{P_f}\right)\left[1 - \left(\frac{P_a}{P_f}\right)\left(\frac{E_a}{E_f}\right)\right]} + 0.025\,V_s \qquad (A\text{-}1)$$

Since the safety loop system is used only when all radiation is below the boiler there is no need to have high initial pressures in the tank and the correction table has been made using only low initial fill pressure from 4 psig to 12 psig.

4. *Correction factors for systems using compressed air to charge the tank.* On large systems in which an attic tank cannot be used it is economical to use compressed air for charging basement tanks. A smaller tank will then be required because almost the entire tank can be considered as an air chamber. For the purpose of this paper, the tank is considered 80 percent full of air under initial or cold conditions. Under these conditions, the equation on which the correction table is based will be as follows:

$$V_t = \frac{(E_w - E_a)V_s}{0.8\left(1 - \frac{P_a}{P_f}\right)} - 0.025\,V_s \qquad (A\text{-}2)$$

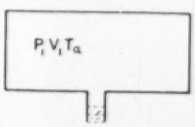
5. *Correction factors for installed tanks which are undersized.* Under unusual conditions, when the amount of water in a specific system is much greater than the average amount on which Table 1 is based, the system will reach relief pressure at low temperature. By the correction factors in Table 1, the necessary increase in *effective tank size* can be determined for the temperature at which the relief valve operates. The *effective tank size* may be increased by lowering the initial pressure, changing the location of the tank, or increasing its size.

APPENDIX B

A. Development of General Equation for Compression Tanks Considering all Factors Involved

In order to develop the general equation for compression tanks a typical compression tank will be considered from its empty to full operating condition. For definitions of symbols see Nomenclature.

(a) *Empty:*



where

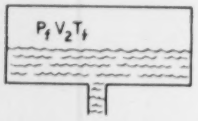
$P_1 = P_a + P_e$

$V_1 = V_t + 0.02\,V_s$

$0.02V_s$ = liberated air from water in system.

Considerations: Water is about to enter tank. In addition to atmospheric air some additional air may have been forced into the tank when filling, thereby increasing the pressure above atmospheric. Additional atmospheric air liberated from the water after heating may also reach the tank.

(b) After initial fill:

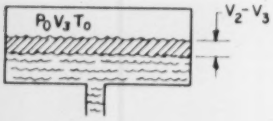


where

$$V_2 = (p_1 V_1 T_f)/(p_f T_a)$$

Considerations: Water has now entered tank changing pressure, temperature and volume of air.

(c) During operation:



where

V_3 = final air volume.

Considerations: During heating of the system, there has been an increase in volume of water in the system, the water in the tank, the system piping, and the tank itself, resulting in a total increase of water in the tank of $V_2 - V_3$. A relation between initial air volume in tank and $V_2 - V_3$ in terms of pressure and temperature is needed as follows:

$$V_2 - V_3 = V_1 \left(\frac{p_f T_f}{p_f T_a} - \frac{p_f T_0}{p_0 T_a} \right) \qquad \text{(B-1)}$$

$V_2 - V_3$ represents increase in total system volume relative to the tank. This can be represented as:

$$V_2 - V_3 = V_s (E_w - E_p) + V_{wt}(E_{wt} - V_t E_t$$

V_{wt}, the volume of water in tank after fill $= V_1 - V_2$ and $V_2 = V_1 p_1 T_f / p_f T_a$. The equations that follow can be made much simpler and more practical if V_1 is substituted for V_t in the term $V_t E_t$. A slight theoretical error occurs in the final expression which for practical purposes is negligible. Subtituting for $V_2 - V_3$ in Equation B-1 yields:

$$V_s (E_w - E_p) + V_t \left(1 - \frac{p_1 T_f}{p_f T_a} \right) E_{wt} - V_t E_t =$$

$$V_t \left(\frac{p_1 T_f}{p_f T_a} - \frac{p_1 T_0}{p_0 T_a} \right)$$

Solving for V_t

$$V_t = \frac{(E_w - E_p) V_s}{\frac{p_1 T_f}{p_f T_a} - \frac{p_1 T_0}{p_0 T_a} - \left(1 - \frac{p_1 T_f}{p_f T_a} \right) E_{wt} + E_t}$$

By substituting $V_t + 0.02V_s$ for V_1 and $p_a + p_e$ for p_1, the equation becomes

$$V_t = \frac{(E_w - E_p) V_s}{\frac{(p_a + p_e) T_f}{p_f T_a} - \frac{(p_a + p_e) T_0}{p_0 T_a} - \left[1 - \frac{(p_a + p_e) T_f}{p_f T_a} \right] E_{wt} + E_t} - 0.02 V_s \qquad \text{(B-2)}$$

B. Evaluation of General Formula Considering Effect of Factors

(a) Pressure-volume or isothermal relationship of tank to system expansion: The factor simply involves the application of the gas laws to the pressure volume relationship.

(b) Temperature changes of air within the tank as this affects pressure volume relationship: Temperature T_a, air temperature in tank before filling, will vary between limits of (460 + 40) F abs to (460 + 90) F abs, depending on the time of year the system is filled. Temperature T_f, would at the instant the system reaches 12 psig, be equal to temperature T_a. With filling water at 40 F there might be a period of time during which air temperature T_f would drop below T_a. The gas law relationship would still hold, so that a change in T_f would not change the basic equilibrium but would only vary p_f and V_2 directly with the change in temperature. From the foregoing $T_a = T_f = 70$ F., approximately. Temperature T_0 remains to be evaluated. The temperature of the air in the tank would vary directly with the amount of gravity flow permitted. On most systems, and especially those having a device to limit gravity flow, the air temperature in the tank would approximate basement air, plus a small temperature rise depending on gravity flow. (460 + 70) F, abs $< T_0 <$ (460 + 90) F, abs. Note should be taken of the safety loop system which would probably have an air temperature approaching boiler water temperature. Leaving the analysis of the safety loop system for later consideration, the general equation can be reduced to:

$$V_t = \frac{(E_w - E_p) V_s}{\frac{p_a + p_e}{p_f} - \frac{(p_a + p_e) T_0}{p_0 T_a} - \left[1 - \frac{p_a + p_e}{p_f} \right] E_{wt} + E_t} - 0.02 V_s \qquad \text{(B-3)}$$

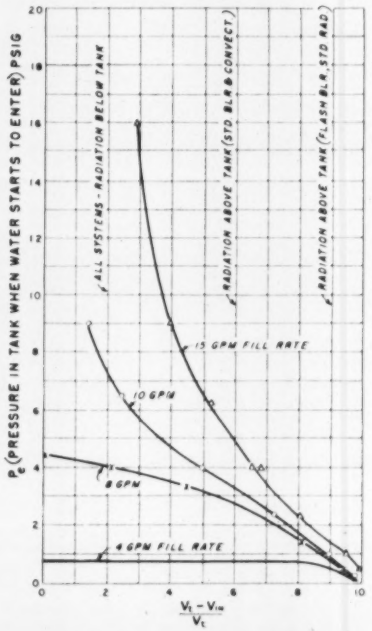


Fig. B-1—Compression tank pressure rise during filling

(c) Expansion of water in system: The factor is obviously of great importance and must be left in the equation.

(d) Expansion of water in compression tank: Generally speaking compression tanks do not reach temperatures high enough to warrant consideration of the water contained in the compression tank except in the case of the safety loop system and the term E_{wt} can therefore be dropped from the expression for the average system.

(e) Expansion of compression tank: Following the same reasoning as in item *(d)* the term E_t can be dropped for the average system.

(f) Expansion of piping, boiler and radiation of system: The volume of water expansion alone does not give a true picture of total system expansion for, as the water expands, the piping, boiler and radiation must also expand giving a total expansion, relative to the system, of water expansion minus system expansion. The term E_p must remain in the expression.

Considering factors from *(d)* to *(f)* the general equation reduces to:

$$V_t = \frac{(E_w - E_p) V_s}{\frac{p_a + p_e}{p_f} - \frac{(p_a + p_e) T_0}{p_0 T_a}} - 0.02 V_s \qquad \text{(B-4)}$$

(g) Liberation of dissolved air when heated: Water at 40 F will contain about 0.024 gal of dry air per gallon of water and at 180 F will contain about 0.004 gal of dry air per gallon of water. Thus if one gallon of water is heated from 40 F to 180 F about 0.02 gal of dry air will be liberated. The volume of liberated air in system water is provided for in the equation by $0.02 V_s$.

(h) Consideration of water-logging of compression tank: Systems employing

a relatively large and direct pipe connection from the boiler to the compression tank will water-log after a period of time. Water-logging of the compression tank will invalidate any method of tank sizing since, after a time, the amount of air in the tank is undeterminable.

(*i*) *The effect of trapping additional air in the compression tank during filling of the system*: The problem basically is concerned with the rate of filling with respect to the air venting capacity of the system. The method of filling should be examined. If the system is vented after initial fill pressure is reached, the tank will have a maximum amount of additional air. If venting is carried on during the fill operation the tank will have a minimum amount. The assumption can be made that most systems will be vented during fill since some time is saved in the filling operation using this method.

The nozzle diameter available for venting can be approximated at 1/16 in. diameter. An approximation for the discharge of free air through a 1/16 in. nozzle can be given as

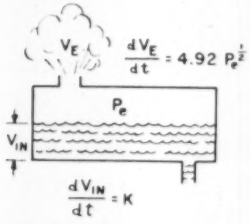
$$dV_E/dt = 4.92\ p_e^{\frac{1}{2}}$$

where

p_e = pressure causing flow in pounds per square inch gage.

$\frac{dV_E}{dt}$ = flow of free air, gallons per minute.

Filling rates can be established as varying between 1 to 20 gpm. Automatic fill valves are installed on about 60 percent of all systems today. They restrict the filling rate to between 3 and 4 gpm.



For a tank from which air is escaping at a rate depending on internal pressure and into which water flows at a rate K the following equation can be written:

$p_a(V_t - V_E) = (p_e + p_a)(V_t - V_{IN})$

where

p_a = atmospheric pressure, pounds per square inch absolute.

p_e = pressure existing in tank at any time when V_E air has escaped and V_{IN} in water has entered, pounds per square inch gage.

V_t = total volume of tank.

V_{IN} = water volume in tank at any time, gallons, or volume of water in system when water starts to enter tank during fill, gallons.

The equation can be differentiated with respect to time and, after proper substitution for filling and air escape rates, can be integrated between proper limits of time and pressure to obtain the following equations:

For filling rates less than 9½ gpm

$$\frac{V_t - V_{IN}}{V_t} = \frac{\left[\frac{2K\sqrt{p_e}\left(-72.2-\sqrt{5220-58.8K^2}\right)+58.8K^2}{2K\sqrt{p_e}\left(-72.2+\sqrt{5220-58.8K^2}\right)+58.8K^2}\right]^{\frac{72.2}{\sqrt{5220-58.8K^2}}}}{\frac{p_e}{14.7}-\frac{4.92\sqrt{p_e}}{K}+1} \qquad (B\text{-}5)$$

For filling rates greater than 9½ gpm

$$\frac{V_t - V_{IN}}{V_t} = \frac{1}{\left(\frac{p_e}{14.7}-\frac{4.92\sqrt{p_e}}{K}+1\right)e^{\frac{144.4}{\sqrt{58.8K^2-5220}}\left[\tan^{-1}\frac{2K\sqrt{p_e}-72.2}{\sqrt{58.8K^2-5220}}-\tan^{-1}\frac{72.2}{\sqrt{58.8K^2-5220}}\right]}} \qquad (B\text{-}6)$$

where

K = filling rate, gallons per minute.

The complete development of the equations may be obtained from the authors.

Fig. B-1 shows the pressure rise in the tank when water starts to enter for the condition that air vents through one 1/16 in. diameter orifice at an air flow rate of $4.92\ p_e^{\frac{1}{2}}$

As will be noted, the pressure rise at 4 gpm fill rate approximates 0.8 psig rise for any type system. The pressure rise for higher fill rates can be substantially above this value, varying for the type of system.

The majority of hot water heating systems use pressure reducing valves for filling purposes, restricting fill flows to 3 to 4 gpm with the result that pressure in the tank when water starts to enter is probably around 0.8 psig. Since the tank sizing method must be based on average systems p_e will be considered as equal to 0.8 psig., though the fact that pressure rise at higher fill rates than those described can be considerably higher, should be recognized.

The general equation can then be stated as:

$$V_t = \frac{(E_w - E_p)V_s}{\frac{p_a + 0.8}{p_f} - \frac{(p_a + 0.8)T_o}{p_o T_a}} - 0.02V_s \qquad (B\text{-}7)$$

Utilizing the approximate temperatures for T_o and T_a as given in item (*b*) and under standard conditions, it can be determined that the effect of temperature and of $p_e = 0.8$ psig are such that they approximately counterbalance one another.

The equation, dropping both p_e and temperature considerations then becomes

$$V_t = \frac{(E_w - E_p)V_s}{\frac{p_a}{p_f} - \frac{p_f}{p_o}} - 0.02V_s \qquad (B\text{-}8)$$

which is Equation 2 of the paper.

C. Development of Equation for the Safety Loop System

(*a*) The safety loop system differs from the average system in that the temperature of the tank approximates boiler temperature.

(*b*) Evaluation of factors generally follows those for the average system except that expansion of water in the compression tank and expansion of the tank itself must be considered. The general equation then reduces to:

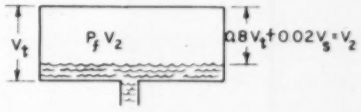
$$V_t = \frac{(E_w - E_p)V_s}{\frac{p_a}{p_f} - \frac{p_a T_o}{p_o T_a}\left[1 - \frac{E_p}{E_w}\right]E_w + E_p} - 0.02V_s \qquad (B\text{-}9)$$

Consideration of the fact that air temperature in the tank will be less than Boiler Temperature allows substitution of p_a for term $(p_a + 0.8)$.

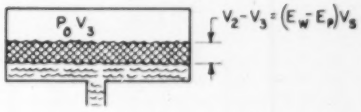
D. Development of Equation for System Using Compressor to Charge Tank With Air

Assume tank 0.8 full of air after initial pressure has been reached. Additional air may be added later after liberation of entrapped air in system.

(*a*) After fill:



(*b*) During Operation:



$$V_2 - \frac{p_f V_2}{p_o} = (E_w - E_p)V_s;\ V_t = \frac{(E_w - E_p)V_s}{1 - \frac{p_f}{p_o}}$$

Substituting: $0.8V_t + 0.02V_s = V_t$ yields:

$$V_t = \frac{(E_w - E_p)V_s}{0.8\left(1 - \frac{p_f}{p_o}\right)} - 0.025V_s \qquad (B\text{-}10)$$

Which is Equation A-2 of Appendix A.

59th Annual Meeting Proceedings

Registration hits all time peak as 2814 members, guests and ladies attend Chicago meeting

THE SOCIETY'S 59th Annual Meeting at the Conrad Hilton Hotel, January 26-29, broke all previous attendance records. At the six technical sessions, reports of the officers were given and technical papers and discussions on a variety of subjects were presented.

FOURTH SESSION, WEDNESDAY, JANUARY 28, 9:30 A.M.

Second Vice Pres. L. N. Hunter called the fourth technical session to order at 9:30 a.m., and reported that the registration at that time had exceeded 2500 members and guests.

Prof. F. W. Hutchinson presented his paper, Friction Losses in Round Aluminum Ducts (to be published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May, 1953).

J. L. YATES, Milwaukee, Wis., suggested that the galvanizing process used to apply the zinc coating should be mentioned, because smoothness of the pipe would vary somewhat with the process.

The second technical paper, Pressure Losses in 4-Inch Diameter Galvanized Metal Duct and Fittings, by H. G. Conn, W. G. Colborne and W. G. Brown (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January, 1953) was presented by Professor Colborne.

D. W. LOCKLIN, Jackson, Mich., suggested that the authors make further comment on the losses shown in Fig. 6, since these losses included other components than the elbows. He suggested that the authors review the work of J. R. Weske as given in the *NACA* Report, W-39 on Aircraft Duct Work. Dr. Weske found very little change in elbow friction loss when a short spacer was added between elbows as shown in Fig. 6.

Mr. Locklin suggested that the authors prepare a summary of data for the 25 composite arrangements of fittings mentioned in the paper, and that this summary be submitted as an appendix to the paper. This would give engineers an indication of the relation between the predicted and the actual loss in composite systems.

AUTHORS' CLOSURE: Professor Colborne stated that the authors of this paper were seeking to establish the form of the curves resulting from rotation of the elbows, rather than the exact pressure losses for these different positions. From the curves it was possible to establish equations that fitted the curves, after which the constants in the equations were evaluated by using results previously obtained and shown in Fig. 3.

The authors' final closure will appear with the paper when published in the ASHVE TRANSACTIONS 1953.

At this point, Treas. J. Donald Kroeker assumed the chair and introduced Prof. S. F. Gilman, who gave an abstract of the paper, Room Air Distribution Research for Year 'Round Air Conditioning — Part I, Supply Outlet at One High Side Wall Location, by S. F. Gilman, H. E. Straub, A. E. Hershey, and R. B. Engdahl (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April, 1953).

As there was no discussion, Chairman Kroeker thanked the authors and those who had taken part in the discussions of the various papers, and adjourned the meeting at 11:30 a.m.

FIFTH SESSION, WEDNESDAY, JANUARY 28, 1:30 P.M.

First Vice Pres. Reg F. Taylor called the meeting to order at 1:30 p.m. in the Grand Ballroom of the Conrad Hilton Hotel. He introduced I. W. Cotton, chairman of the Committee on Research, who presented the 1952 Annual Report of the Committee on Research (published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March, 1953, p. 148).

After Mr. Cotton had presented his report, Chairman Taylor referred to his services to the Committee on Research during the past two years, and commended him on the results achieved. He felt certain that Mr. Cotton would still be rendering service to the Society on various committees during the coming years.

The first technical paper, Field Studies of Floor Panel Control Systems, by A. B. Algren, E. F. Snyder, Jr., and J. S. Locke (published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1953) was presented by Mr. Snyder.

This paper is the result of a cooperative research project between the Society and the University of Minnesota. There were no discussions of the paper.

The second technical paper, Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee and C. M. Humphreys (published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, December, 1952) was presented by Mr. Schutrum.

W. P. CHAPMAN, Pittsburgh, Pa. (WRITTEN): The very length and scope of this paper indicates the effort the authors have put into their investigation. It is rarely possible for a reader to contribute a great deal when the disparity of time and thought is as great as it must be in this case. I, therefore, restrict my comments to a question, an observation, and a request.

First, the question: What was the magnitude of gaseous absorption of radiation? It was mentioned that, *Dew point temperature had a measurable affect on room air temperature because of absorption.*

Prof. F. W. Hutchinson, in a paper published in the ASHVE JOURNAL SECTION of *Heating, Piping & Air Conditioning* in November, 1946, theorizes that gaseous absorption is of the magnitude of 10 percent in an *average* room under *average* panel heating conditions. With metallic wall surfaces the 10 percent would be increased of course. Here is an excellent opportunity to test the equations developed in Professor Hutchinson's paper. True, this would be a by-product, but a valuable bit of information just the same.

The second comment — an observation — concerns the third method used to calculate the infiltration load. It is stated that, *It was found that if the temperature of the air leaving through the cracks between the panels was assumed to be equal to the area-weighted average temperature of all room surfaces, and this was averaged with the measured exit temperature, Method 3 gave good correlation with the other two methods.* In other words, the exfiltrating air approached the AST. In the past, it has been assumed that exfiltration occurred at room air temperature. Since in usual conditions the AST is lower than the air temperature, it seems that infiltration loads can easily be reduced. This point certainly deserves further consideration, especially since exfiltration generally occurs around doors and windows in a far greater proportion than in any other way.

My third point is a request. I would like to request clarification of the convection problem. Two values were given for the convection coefficient: 0.80 and 0.04. This is a 20 to 1 ratio. As the authors imply, the probable coefficient for practical application will be somewhere between these two extremes.

The only way to clarify this problem is to carry out tests for a range of air velocities and then compare the test velocities to actual field velocities. It would be ineffective to say that velocities of 25 fpm produced a convection coefficient of 0.4 unless it was also stated that velocities of 25 fpm are the most likely to be found in practice.

This one paper has opened, or reopened, four fields of investigation: (1) the magnitude of gaseous absorption in a panel heating system, (2) the determination of the temperature of exfiltrating air, (3) the determination of the variation of convection with air velocity, and (4) the determination of the most probable air velocity to be found in a panel heated room.

J. R. CARROLL, Urbana, Ill. (WRITTEN): The Society and its Committee on Research should be highly commended for expending their time and funds in providing such basic research facilities as the Environment Laboratory. For a long time we have sought panel heating data. Now we have a basic research tool by which some of the theoretical data can be correlated against field test data obtained in the past.

This paper presents data on the total heat transfer to a uniform environment in which a ceiling panel is contained within the confines of the walls, and illustrates less heat transfer than theoretical rates based upon the extrapolation of data obtained from research on small and relatively unrestricted high temperature sources such as wires, spheres, cylinders, and vertical plates. These are the only data previously available. The authors mention that an apparent difference does exist and, after subtracting some value representing the radiation component of the total heat transfer, they present $h_c = 0.04$ Btu per (hr) (sq ft) (F deg) as representing the unit convection conductance. It should be noted, however, that this free convection coefficient is based upon the observed air temperature difference between the air at the 60-in. level in the room center and the average ceiling surface. It would have been a different number if the air temperature were taken at some other level due to the rapid increase of air temperature gradient close to the ceiling because of the confinement of the ceiling within the room.

When operated with a fan blowing at the ceiling, the coefficient h is increased to 0.80 and the air temperature at the 60-in. level at the center of the room also increased to 80.7 F. Since the authors state that the radiation exchange was essentially the same for the two tests from which these two coefficients were derived, the calculated radiation component is approximately 56.2 Btu per (hr) (sq ft). By applying this same radiation component to the data of Table 2, which include infiltration and which also have essentially the same surface temperatures and, therefore, the same radiation exchange as the other data, it is found that $h = 0.14$. This increase compared to $h = 0.04$ is due to the lower room air temperature at the 60-in. level and the higher rate of heat transfer because of the infiltration air and serves to illustrate that h is not a constant but varies with application, and since an actual application includes infiltration, it is desirable to know this variation.

This paper does not develop the relationship between free convection heat transfer and temperature difference directly, but I feel that if the data are available it should be accomplished in order to fill in a large gap in heat transfer history. All of the previous reported work has been done with vertical surfaces and small objects in which the air flow is unimpeded. The following is a list of such relationships as reported by various investigators for a warm surface facing down:

Nusselt, Henky, Hottinger	$q_c = 0.22\,\Theta^{1.25}$
Wilkes, Peterson	$q_c = 0.38\,\Theta^{1.00}$
King	$q_c = 0.15\,\Theta^{1.33}$
McAdams	$q_c = 0.20\,\Theta^{1.28}$
Heilman	$q_c = 0.16\,\Theta^{1.27}$

W. J. King, however, specifically noted that the relationship did not apply to *large* horizontal warm surfaces facing downward. Since it appears as if the data may now be available from this excellent work at the ASHVE laboratories, I would like to suggest that this basic heat transfer relationship be determined for the ceiling position.

D. L. MILLS, Rome, N. Y. (WRITTEN): As a member of the Technical Advisory

Banquet goers shown enjoying remarks of Toastmaster C. M. Burnam, Jr., at 59th Annual Banquet

Committee on Panel Heating, this paper is of particular interest to me.

We are glad to see the fact emphasized that the data given in the paper pertain only to the particular room in which the investigation was made. This is very important because of the tendency to use data obtained in a laboratory for designs affected by field conditions that may be very different from those in the laboratory.

Even if no other technical papers were published, this paper alone shows the great potential value of the Environment Laboratory. Any reader will be impressed by the closeness with which the room surfaces can be held to desired values, and the accuracy of the energy balances that is possible in this room. The authors deserve commendation for their careful work and clear exposition.

The first observation in the Summary states that the convection conductances obtained from the ceiling panel appear to be much lower than presently published data would indicate. This leads us to ask whether the authors can suggest a convective film coefficient that might safely be used for design purposes in the average residence.

While it is to be expected that uniform surface temperatures and an absence of infiltration would affect the heat transfer by convection, from a ceiling panel, it is interesting to see how low this rate of transfer would actually be under such conditions.

It is also interesting to note from actual tests, the influence of air movement over a heated panel on the heat output from it.

H. B. Nottage, Los Angeles, Calif. (Written): These interesting and long-needed results, the first of a series, present important factual information. How to represent these data in a systematic, rational and flexible manner is a basic consideration. A promising approach, capable of straightforward simplification for practical use, is the technique of representing thermal circuits by electrical circuits.

Thermal circuits for air conditioning have been under study recently at the ASHVE Research Laboratory, and a paper is in preparation. It is suggested that the authors present and condense their results by this method. For example, Fig. A shows electrical circuits representing thermal conditions in the Environment Laboratory under the condition of uniform ceiling and unheated-surface temperatures.

The potentials, resistances, and currents in this system are inter-related by standard circuit equations. Some complication of detail can arise from the fact that resistances and potentials may be inter-dependent, although simplifying approximations can easily be justified in practical usage.

The more complete case of different temperatures of the various room surfaces is representable by a circuit having additional branches.

Circuit techniques, supported by valid

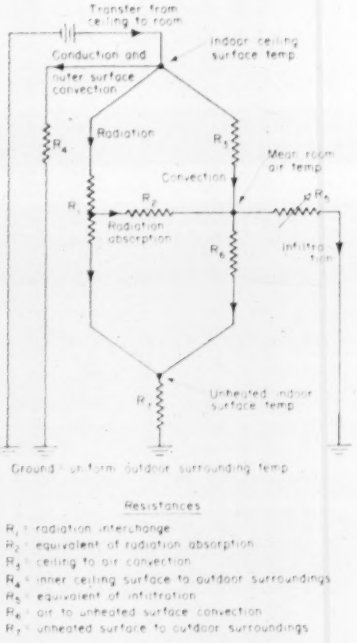

Transfer from ceiling to room
Conduction and outer surface convection
Indoor ceiling surface temp
Radiation
Mean room air temp
Convection
Radiation absorption
Infiltration
Unheated indoor surface temp
Ground = uniform outdoor surrounding temp
Resistances
R_1 = radiation interchange
R_2 = equivalent of radiation absorption
R_3 = ceiling to air convection
R_4 = inner ceiling surface to outdoor surroundings
R_5 = equivalent of infiltration
R_6 = air to unheated surface convection
R_7 = unheated surface to outdoor surroundings

Fig. A — Electrical circuit representation of thermal conditions in Environment Laboratory (For uniform heated ceiling and uniform unheated surfaces)

data on resistances, will enable the authors to treat more properly the following items in their paper:

1. Gaseous radiation.
2. Limitations on average surface temperature, AST.
3. Limitations on average unheated surface temperature, AUST.
4. Relation between air temperature, ceiling temperature, and average unheated surface temperature, AUST.
5. Reflected radiation.
6. Relation between AUST and a more complete description of non-uniform surroundings.
7. Furnishings and sources within the room.

The comprehensive problem is not easy, but concise definition and an experimental program guided by circuit principles should be very helpful.

F. E. Giesecke, New Braunfels, Tex. (Read by C. H. Flink): This paper is an excellent report of a valuable study well performed. As it is necessarily complicated I hope the authors will later recommend simple rules and methods by means of which the practitioner can easily design radiant heating and radiant cooling systems, with sufficient accuracy for practical purposes.

For example, the chart of Fig. 1 is very similar to the theoretical chart which I published about 13 years ago, in the August 1940 issue of *Heating, Piping & Air Conditioning*. For a ceiling temperature of 100 F, the chart of Fig. 1 shows a *total heat flow* of 50, 41, 37, and 33 with an average of 40.25 Btuh per sq ft when the average temperatures of the five unheated surfaces are, respectively, 50, 60, 65, and 70 F. For the same temperature differences, my theoretical chart shows a *total radiant heat flow* of 48, 39, 35, and 31 with an average of 38.25 Btuh per sq ft.

If the two charts are comparable, the *total convected heat flow* is 40.25 less 38.25 Btuh per sq ft or about 5 percent of the total radiant heat flow, when the ceiling is the heating panel.

Some such simple relation of *convected* heat flow to *radiant* heat flow, for the several possible locations of the heating panel, would be of value to the designer.

In designing my theoretical chart I assumed that the ceiling heating panel was completely enclosed by the floor and the four walls so that the radiant heat flow is $0.156\ [(T_1/100)^4 - (T_2/100)^4]$ Btuh per sq ft if the mean emissivity of the surfaces is 0.9 and if T_1 is the average absolute temperature of the heated surface and T_2 is the area weighted average absolute temperature of the unheated surfaces which enclose the heated surface.

If the authors will determine whether this approximate method of calculating the radiant heat flow is sufficiently accurate for design purposes, for rooms of ordinary size and ordinary proportions, they will render an additional service to the profession.

R. J. Vinette, Chicago, Ill., cautioned that it must not be assumed from the data presented that calculations for a uniform room could be applied to a non-uniform room. An example of an extreme case would be a room having a very large picture window representing a very cold surface. In this case the calculated radiant output from the ceiling would be quite different if based on the average unheated surface temperature than it would be if the geometrical configuration were taken into account.

Mr. Vinette suggested that interesting data could be obtained from tests in a room having a very large, extremely cold wall, simulating a large picture window in a solar heated house. If the output of the heated panels could be compared for the *actual* AUST and the AUST of a room having a uniform temperature of the unheated surfaces, the results would either confirm or indicate the inaccuracy of the present more or less accepted theoretical conclusions.

A. T. Johns, Libertyville, Ill., referred to his own experiments, in which it was found that the actual output of panels could not be correlated with the output computed by textbook theories. He reported that research conducted at the Armour Research Foundation had shown results comparable to some of those in the paper. Tests at Armour were conducted in a room having one cold wall. The question was raised regarding the effect of the non-uniform temperature of heated panels caused by the variation in

temperature with the location of the pipes within the panel.

In recent tests conducted by Mr. Jorn, he found that the arithmetic average panel surface temperature obtained by measurements on the surface of the panel from tube to tube appeared to be satisfactory for the purpose of calculation. This average temperature would not be satisfactory, however, for tubes having so wide a spacing that the point midway between the tubes would approach the average unheated surface temperature.

It had also been found in Mr. Jorn's tests that for radiant cooling using a cool ceiling, the computations for an actual installation would agree with results from a test room, if the Stefan-Boltzmann radiation law and the formula from Chapter 23 of THE GUIDE, 1952, for radiant heating from the floor, were used to determine the heat transfer.

Mr. Jorn stated that it had been possible to prepare design graphs from his own test work and from the ASHVE Laboratory Reports and that these graphs would be available for those interested in designing panel heating and cooling systems.

P. B. GORDON, New York, N. Y., pointed out that this was a report of only the first investigation using the new Environment Laboratory, and that other work already planned in the study of panel heating and panel cooling would require many years to complete.

He emphasized that results reported could not be applied to rooms of other dimensions, and that further investigations would be needed before it would be possible to use the data for rooms of other sizes.

Additional research which is already planned will include tests on floor panel outputs under conditions similar to those reported in the paper, and later on, the effect of non-uniformity of wall temperatures including various combinations of heated panels in different locations.

P. R. ACHENBACH, Washington, D. C., reported that he had made some comparisons of results obtained in the four-room test bungalow of the National Bureau of Standards and those shown in Fig. 1 of the paper, and had found a very close agreement of total heat output for any given ceiling temperature and average unheated surface temperature. The results in both cases agreed within about two Btu per square foot of surface. He suggested that conclusions about the deviation of heat transfer and convection should be held in abeyance until further research had been conducted.

It was noted in the paper that for a uniform environment about 43 percent of the ceiling heat output was intercepted and transmitted by the floor. In a typical house construction the heat transfer through the floor would be nearer 10 to 15 percent of the total heat loss of the building, and it would therefore be assumed that in the tests reported in the paper all radiant heat received was transmitted because the air was either warmer than, or at the same temperature as, the surfaces.

In a house where the floor is only transmitting 15 percent of the heat, the floor will be warmed above the air temperature, and convection at the floor will increase considerably the heat transferred by convection in a non-uniform environment.

Mr. Achenbach suggested that in addition to controlling the surface temperatures at typical values, it would also be desirable to adjust the conductance and transmissivity factors to typical values so that a typical rise in surface temperature above air temperature would be obtained and thereby produce typical convection effects.

While the paper reported that convection was only about 10 ft per min, it had been Mr. Achenbach's experience that an appreciable upward flow of air is obtained in the center of a room accompanied by a downward flow near the cold walls.

It was also noted in the paper that in tests with non-uniform environment, the heat transferred by the floor was nearer that of a typical house, but was, nevertheless, greater.

AUTHORS' CLOSURE: Mr. Humphreys stated that daily tests on a two-shift basis have now been made for approximately a year in the new Environment Laboratory.

In reply to Mr. Chapman, Mr. Humphreys stated that the absorption of radiant heat by water vapor in the air would vary between 700 and 1200 Btu per hr in the test room.

With regard to the temperature of escaping air, no attempt had been made to obtain conditions similar to those which might apply for a standard building. The temperature of the escaping air was approximately the temperature at the 30-in. level.

Referring to Dr. Giesecke's comments, Mr. Humphreys reported that the percentage of convection was found to agree quite well with the difference between the total measured heat output of the panel and the radiant output as calculated by Dr. Giesecke. The relation between radiation and convection output is being given further investigation.

Mr. Humphreys stated that plans were being made to use the thermal circuit suggested by Mr. Nottage as a means of analyzing the heat flow problems in the Environment Laboratory. Work is being done in evaluating the resistances to be used in the circuit.

While additional tests on non-uniform conditions are being contemplated, it will be noted that in the series of tests reported as No. 1 in Table 4, the entire east wall was maintained at a temperature of approximately 29 F without causing any important difference in the ceiling heat flow in the non-uniform environment as compared with the uniform environment.

The complete discussions and the authors' final closure will be printed with the paper in the ASHVE TRANSACTIONS, 1953.

The third technical paper, The Shading of Sunlit Glass — An Experimental Study of Slat-Type Sun Shades, by G. V. Parmelee, W. W. Aubele, and D. J. Vild (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January, 1953) was presented by Mr. Parmelee.

R. W. MCKINLEY, Pittsburgh, Pa., suggested that a study be made of the effect of radiation that might be reflected upward between the slats of the shade from the ground or other horizontal surface.

He also suggested that the final report on the performance of shading devices should include some reference to ventilation and the transmission of light.

CYRIL TASKER, Cleveland, Ohio, gave a brief review of the ASHVE investigations of shading devices to date, and indicated that the study of shading devices followed logically after the research work on unshaded glass had been completed. The object of the research work on shaded and unshaded glass is to obtain, eventually, important design data for the determination of the cooling load.

R. A. MILLER, Pittsburgh, Pa., spoke of his attempts over a large number of years to obtain the cooperation of the Society and the *Illuminating Engineering Society* in the solution of problems involving light and heat transfer through glass. It was evident that not only these societies but also those who manufacture shading devices should be vitally interested in this research project and should participate in it because of its importance.

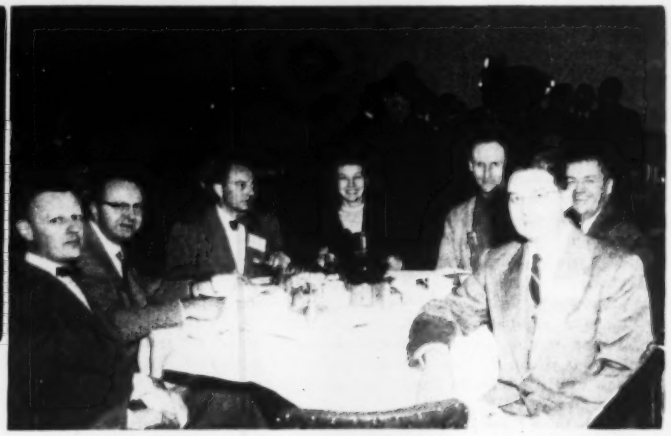
AUTHORS' CLOSURE: Mr. Parmelee stated that Mr. McKinley's suggestion indicated the need for a continuation of the research on shading devices. In the selection of the proper slat angle and color, the designer needs to take into account not only the transmission of heat, but also the transmission of light in order to obtain the best compromise between natural light, minimum heat transmission, and ventilation.

It was recognized that much solar radiation can be reflected upward from concrete surfaces of parking lots, light colored gravel, and other horizontal surfaces, and that a high percentage of this reflected radiation would be transmitted by slat-type shades.

In certain cases the amount of such upward directed radiation might be sufficient to warrant the setting of the slats in a direction opposite to that used to decrease direct solar radiation transfer.

Chairman Taylor thanked the authors and those who had discussed

California meets Tennessee — *(l. to r.)* General W. A. Danielson, Memphis, Mr. and Mrs. A. J. Hess, Los Angeles



Members enjoying Chicago hospitality during one of the Meeting's entertainment highlights

the papers, and adjourned the meeting at 4:00 p.m.

SIXTH SESSION, THURSDAY, JANUARY 29, 9:30 A.M.

Second Vice Pres. L. N. Hunter called the meeting to order and introduced Prof. Linn Helander, who presented the paper, Maximum Downward Travel of Heated Jets from Standard Long Radius *ASME* Nozzles, by Linn Helander, Shee-Mang Yen, and R. E. Crank (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March, 1953).

The second technical paper, Air Velocities in Ventilating Jets, by G. L. Tuve (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January, 1953) was presented by the author.

Professor Tuve stated that those who study air distribution by means of research need information on field practice. He therefore read five questions indicating the type of information which should be obtained from engineers who are concerned with design and installation of air distribution systems:

1. Do we need to know more about ceiling plaques?
2. Do you ever make jet-pattern layouts to scale for your important jobs. If not, why not?
3. How do you check a job for drafts? Do you wait for complaints? Have you tried using a man stripped to the waist for finding draft spots? Do you use instruments to check air velocity? Are 50 percent of jobs free from drafts?
4. Do you ever try to determine the percentage of the unoccupied zone you are actually using for jet mixing? Is it 50 percent?
5. What information should THE GUIDE contain to enable you to predict air distribution performance and make field adjustments unnecessary?

H. B. NOTTAGE, Los Angeles, Calif. (READ BY C. H. FLINK): Milestones are worth noting. This paper gives an application-minded condensation of extensive experimental work. By now we know how to treat isothermal, free-space jets, limiting our interest to velocities above 50 fpm. Where data are not yet available, we know how to obtain them. Priority of time and effort is the major consideration.

What of the future? Predictions are in order, and I wish to suggest strong emphasis upon non-isothermal air distribution in confining spaces. The means are at hand to really grasp these problems. We have the keys to a systematic, simplifying approach. Careful, persistent experimentation; judicious use of fundamental principles; and artful, engineering-wise empiricisms will break this field wide open.

To be specific, we need:

1. Means of estimating maximum jet velocities. A few guiding experimental data will provide this.
2. Means of estimating jet boundary envelopes. The velocity boundary is best defined as the surface of zero mean-velocity component in the direction of the maximum (or axial) jet velocity. The temperature boundary will differ from the velocity boundary.
3. To apply the principle of conservation of mass within the confining space. This will establish the balance of flow rates between the various identifiable streams.
4. Magnitudes of the eddy viscosity and the turbulent Prandtl number. These will establish the cross-stream velocity and temperature profiles.
5. Application of the principle of energy conservation. This refers particularly to thermal energy with non-isothermal flow.
6. Application of momentum-principle force and moment balances. Remember that the axial component of jet momentum flow rate is constant *only* when the discharge space is infinite.
7. Faith in our abilities, willingness to be meticulous but practical in our much-needed experimentation, and far-sighted courage to finance this type of research.

If we want application data, let's forge ahead and get them.

CYRIL TASKER, Cleveland, Ohio, referred to the plans of the Committee on Research and the Technical Advisory Committee on Air Distribution for translating the air distribution information gained during the past 20 years into practical working data. He mentioned that the Report on Jets in Room Air Distribution, consisting of three volumes, prepared as a thesis for a Ph.D. by Dr. Nottage, was an invaluable source of information on the subject, and that several requests had been received at the Research Laboratory for permission to borrow this report. He also stated that the paper presented by Professor Tuve indicated real progress in summarizing previous work on air distribution.

Mr. Tasker suggested that Society members concerned with air distribution problems should consider seriously the questions asked by Professor Tuve, and then send their answers or comments to the Research Laboratory in order that those working on the application of the air distribution data would have the benefit of these comments.

The third technical paper, Cooling a Small Residence with a Two-Horsepower Mechanical Condensing Unit, by H. T. Gilkey, D. R. Bahnfleth, and R. W. Roose (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February, 1953) was presented by Mr. Gilkey.

G. V. Parmelee, Cleveland, Ohio, pointed out that the paper puts new emphasis on the need for understanding thoroughly the effect of the heat capacity of the internal structure of a building in causing the actual cooling load to be considerably less than the instantaneous rate of heat gain.

The paper also represents one of the first attempts to correlate field test data with the periodic heat flow theory, since Prof. C. O. Mackey brought out his useful sol-air temperature concept and provided a practical method of calculating heat gains during a periodic variation in air temperature and the solar radiation incident upon a wall or roof.

It was suggested that the authors make further comparisons of the measured flow with the calculated heat flow rates because of the big differences obtained. The differences indicated that the design sol-air temperatures now in use might not be the same as actually obtained in practice.

Mr. Parmelee suggested that since the authors have the value of the incident solar radiation on a horizontal plane, they should make a new estimate of the sol-air temperature that prevailed at the time of test, and then use this value to determine the design load. A comparison of this design load with the estimated heat load might indicate whether the sol-air temperature originally used was in error.

I. A. Naman, Houston, Tex., inquired whether the ventilation air was measured constantly to determine whether infiltration was affecting the rate of flow of the outside air introduced, and whether wind velocities were taken into account in trying to correlate test data with calculated values.

Authors' Closure: Mr. Gilkey stated that the ventilation air rate was measured constantly and was found to be quite constant during the day. Wind velocity did not affect the infiltration air because a pressure was maintained within the residence at all times during the summer.

No attempt was made to correlate heat transfer through the surfaces with the wind velocity effect on surface conductance.

In reply to Mr. Parmelee, Mr. Gilkey stated that the authors hoped to continue the study in order to correlate actual field test data with the periodic heat flow theory. This would provide further information on the value of the sol-air temperature concept developed by Professor Mackey.

Installation of Officers

As this concluded the technical session, Chairman Hunter requested S. H. Downs, Kalamazoo, past president of the Society, to conduct the installation of the new officers of the Society.

Mr. Downs: "Members and guests of The American Society of Heating and Ventilating Engineers, we now come to the end of this very successful, and I consider, very important meeting. We have assembled on the rostrum at the moment the incoming officers and outgoing officers, with the exception of one, Ernest Szekely, our president, has done a very fine job all during the year in spite of his handicap of illness following an operation, and I would like to have every member stand up and give Ernest a hand for sticking to the job, even though he was handicapped in that manner."

Mr. Downs then introduced the newly elected president, Reg F. Taylor, Houston, Tex.

President Taylor: "Mr. Downs, members and guests: This ceremony makes me realize the fact that there now rests on my shoulders the responsibility for the administration of a wonderful society, a society which in itself is unique among engineering groups. I joined it 38 years ago and for the past six or seven years I have participated in its administration. The men with whom I have been associated in handling Society affairs have all been intensely interested and solicitous of the Society's welfare. In continuing on with them, I am confident that the Society will grow in stature and add to its past contributions to the health and welfare of our fellow men. You may be assured that it will be my purpose to increase the Society's prestige and maintain its high standing as an engineering society.

"There is, of course, much to be done and much that can be done, and it is my hope that at this time next year you will be able to evaluate our accomplishments for the year 1953 and that you will find them to be satisfactory. This future report will no doubt be made in my home town of Houston in January 1954. Consequently, it had better be good. Thank you."

Mr. Downs presented L. N. Hunter, Johnstown, Pa., First Vice President; John E. Haines, Minneapolis, Minn., Second Vice President; and John W. James, Chicago, Ill., Treasurer, each of whom acknowledged the honor conferred upon him as follows:

Mr. Hunter: "I just want to thank you for your expression of confidence in me and to assure you that I will do my best to discharge the responsibilities of this office."

Mr. Haines: "I also want to express my thanks for the confidence you have shown in me and I shall certainly do my best in this new office."

Mr. James: "I thank you for this honor."

The new members of the Council, I. W. Cotton, Indianapolis, Ind., A. W. Edwards, Cincinnati, Ohio, L. T. Mart, Kansas City, Mo., Prof. E. R. Queer, State College, Pa., and B. L.

Back row *(l. to r.)*: J. H. Fox, Toronto; Mrs. W. M. Wallace, II, Durham, N. C.; Mrs. C. O. Mackey, Ithaca; Fred Janssen, Denver; G. W. Williams, Salt Lake City. Front row *(l. to r.)*: Mrs. G. A. Linskie, Dallas; Mrs. T. H. Urdahl, Washington, D.C.; and Prof. B. H. Spurlock, Jr., Boulder, Colo.

Evans, St. Louis, Mo., were introduced with the following comment by Mr. Downs:

"In 1944 and the few years before we were wondering whether we dared to expand, but the way history has written the book it wasn't whether we dared to expand or wanted to; it was actually forced on us and I can still see that it is being forced on us. I therefore believe that your incoming officers have probably the best opportunity for obtaining results and improving the standing of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS that has been offered to any set of officers that ever stepped into the office."

Mr. Downs announced that the induction of the officers concluded the business of the meeting and presented the official Society gavel to Mr. Taylor, the incoming president.

President Taylor called for a report of the Resolutions Committee, which was presented by Prof. B. H. Spurlock, Jr., Boulder, Colo., chairman.

Resolutions

It is only fitting that we honor our dead and it is proper as we lay away, this, the 59th Annual Meeting of our Society that your Committee propose the following resolutions:

WHEREAS, For the 59th time, THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has convened for its Annual Meeting, this time in Chicago, a city of great erudition, culture and hospitality, as guests of Illinois Chapter of the Society; and

WHEREAS, Under the capable direction of our Society's Officers and Staff, the technical sessions have been most successful in that much wisdom and useful scientific data were orally presented and knowledge abundantly gained by the listeners; and

WHEREAS, W. A. Kuechenberg, G. W. Bornquist, and M. W. Bishop, assisted by the entire membership of the Illinois Chapter, by arrangement of social activities have given to ladies and gentlemen alike, delightful bits of fun, feast, Fields (Marshall), and Faust, and

WHEREAS, Dr. Preston Bradley in a most entertaining manner extolled the virtues of Chicago and mankind (with certain reservations); and

WHEREAS, The 11th International Heating, Ventilating and Air Conditioning Exposition reached a new peak in quality as well as size; therefore,

BE IT RESOLVED, That we express our sincere gratitude and thanks:

TO the Illinois Chapter, its Officers and Committees, who engineered and operated a most pleasant and streamlined meeting.

TO the windy city, Chicago, for a week of controlled weather and unstinted hospitality,

TO the Chicago Convention Bureau and Hotels Management for so competently housing and caring for us,

TO the authors of the technical papers and to those who participated in the discussions,

TO the daily press, the technical press and radio for their assistance in making available to the public our Society's accomplishments in improving the comfort and health of mankind,

TO C. M. Burnam, Jr., for his delightful introduction of our guests and speakers, and to Nathaniel Leverone for his special message on This Freedom of Ours,

TO Chicago's own Everett N. McDonnell, who has devoted so much of his time and energy to furtherance of our Society's aims and who was here recognized in token by the F. Paul Anderson Award,

TO Dr. Bradley, who has inspired us to say,

"Good - By God - we've been to Chicago."

Respectfully submitted,
The Resolutions Committee
F. H. Faust, Bloomfield, N. J.
A. N. Hoss, Portland, Ore.
B. H. Spurlock, Jr., *Chairman*,
Boulder, Colo.

C. L. Fleming, Houston, Tex., requested an opportunity to offer the first business for the new year, a tribute to President Taylor in the form of a leather bound book containing letters of regard and reminiscence from friends of the new president. This book contained a large number of autographs and also had provision for insertion of additional letters, autographs, and other items of interest which the president might receive during his year in office.

President Taylor expressed his thanks to his many friends who had presented him with the book.

As there was no business to be transacted, the 59th Annual Meeting was adjourned at 11:30 a.m.

The pictures taken during the Annual Meeting, and shown on these pages and throughout the Proceedings in the March issue, are published through the courtesy of William Wallace, II, of Durham, N.C.

CORRECTION

The authors of the paper, Cooling A Small Residence with A Two-Horsepower Mechanical Condensing Unit, which appeared in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1953, page 109, regret the errors in Table 4 and present the following revised table indicating corrections in Columns 1, 2, 3 and 4.

Table 4—Time Lags and Times of Occurrence of Maximum Temperatures and Heat Flow in the Walls and Ceiling of Research Residence No. 2

Date	Wall Orientation	Time Maximum Value Occurred, CST: Exterior Surface Temp (1)	Room Side of Insulation Temp (2)	Heat Meter (3)	Interior Surface Temp (4)	Exterior Surface to Interior Surface Time Lag, Hr Col. (4) - Col. (1)
7-21-52	East	9:00 a.m.	11:10 a.m.	11:15 a.m.	11:00 a.m.	2.0
	South	2:00 p.m.	4:15 p.m.	3:20 p.m.	3:50 p.m.	1.8
	West[a]	4:10 p.m.	5:40 p.m.	6:10 p.m.	5:50 p.m.	1.5
	North	6:00 p.m.	6:10 p.m.	7:10 p.m.	6:15 p.m.	0.5
	Ceiling[a]	3:00 p.m.	5:00 p.m.	5:00 p.m.	4:25 p.m.	1.4
7-22-52	East	9:20 a.m.	11:50 a.m.	11:00 a.m.	12:00 noon	2.7
	South	1:20 p.m.	3:30 p.m.	2:40 p.m.	2:30 p.m.	1.5
	West[a]	4:10 p.m.	5:40 p.m.	5:50 p.m.	5:25 p.m.	1.5
	North	5:45 p.m.	6:45 p.m.	8:00 p.m.	6:30 p.m.	0.8
	Ceiling[a]	2:40 p.m.	5:00 p.m.	4:30 p.m.	4:15 p.m.	1.6

[a]Values for these orientations may be noted from Figs. 5 and 6, respectively.

Westward and Upward is Goal for Semi-Annual Meeting 1953

Highway to the Stars

One of the many highways just west of Denver that takes you to the snow-capped peaks (snow-capped the year around), spruce-scented air, restful solitude of sun-spotted trails, the icy refreshment of pure mountain water, and healthful relaxation.

Denver, at the foot of the snow-capped Rockies, one mile above sea level, will be the site of the ASHVE Semi-Annual Meeting 1953. The Rocky Mountain Chapter Committee on Arrangements for this meeting, the first ever to be held in Colorado, is now completing plans for the three day period, June 29-30 and July 1. There will be the traditional banquet and several sightseeing trips to the nearby mountains. The annual golf tournament will take place to determine the winner of the Research Cup, the Eichberg Memorial Trophy and the Paul Bunyan Cup. The Program and Papers Committee, under Chairman B. H. Spurlock, Jr., has scheduled three technical sessions which will include papers on heat pump design and performance, effect of relative humidity on heat losses of individuals in various temperatures, heat exchanges in floor panel heated rooms and heat flow analysis in panel heating and cooling sections, and cooling tower performance.

Denver, with a population of almost half a million, is by far the largest city in the country at an altitude of one mile. This has given the city its famous dry, clear climate. Originally Denver was the gathering place for hard-rock gold miners and silver miners. Today, in addition to

Committee on Arrangements

Fred Janssen, *General Chairman* — E. A. Thompson, *Vice Chairman*

Prof. B. H. Spurlock, Jr., *Honorary Chairman*

Banquet — W. R. Egan, *chairman*; J. F. LaTorra, *vice chairman*

Entertainment — J. R. Wilson, *chairman*; H. L. Wray, *vice chairman*

Finance — J. F. Mohan, *chairman*; L. L. DeLong, *vice chairman*

Ladies — H. H. and Mrs. Herman, *chairmen*; Paul and Mrs. Von Rosenberg, *co-chairmen*

Publicity and Attendance Promotion — W. V. Burbank, *chairman*; J. V. Berger, *vice chairman*

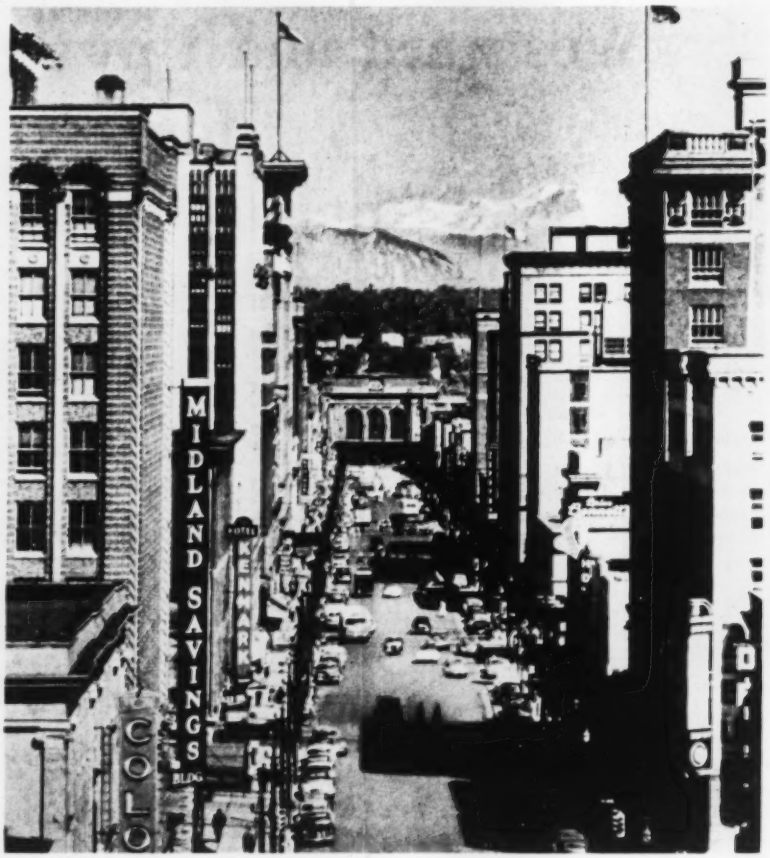
Reception — K. H. Smith, *chairman*; R. G. Look, *vice chairman*

Sessions — F. C. Allen, *chairman*; H. V. Cook, *vice chairman*

Sports — Elmo Hall, *chairman*; G. L. Bradbury, *vice chairman*

Transportation and Special Events — J. H. McCabe, *chairman*; L. D. Niblack, *vice chairman*

The "Wall Street of the West"—17th Street, looking from Broadway west to the Rockies in downtown Denver



its tourist business, Denver has become a major western industrial center, with many big corporations having plants in this area. Denver, served by seven railroads, six airlines, and a network of fine roads is the gateway to all of Colorado's famed scenic mountain attractions. In nearby Central City, called the *richest square mile on earth*, the Glory Hole Mine and the Lost Gold Mine can be visited. Just a short drive from Denver is America's highest automobile highway which goes to the top of Mt. Evans, 14,260 ft above sea level. Rocky Mountain National Park with its Trail Ridge Road along the Continental Divide, takes the visitor into some of Colorado's finest resort areas, and past the Colorado-Big Thompson Transmountain Diversion Project.

The Rocky Mountain Chapter is planning a Colorado welcome for members of the Society with an excellent meeting program outlined. Plan on being in the Mile High City on June 29-30 and July 1.

Typical *Round Trip* Airline and Railroad Fares to Denver

Airline*

Boston	$210.70
Chicago	110.40
Cleveland	146.50
Dallas	82.78
Detroit	139.36
Houston	117.10
Kansas City	71.70
Los Angeles	115.40
Memphis	116.10
Minneapolis	96.42
New Orleans	142.50
New York-Newark	194.18
St. Louis	98.60
Salt Lake City	53.29
San Francisco	123.70
Seattle	141.26
Philadelphia	186.85
Vancouver	156.37
Washington, D. C.	180.31

*Plus 15% Transportation Tax

Railroad†

	Railroad Round-Trip	Lower Berth One-Way
Little Rock (via K.C.)	$ 58.35	$ 14.30
Atlanta	91.40	14.30
Baltimore	125.95	16.60
Vancouver	91.40	14.80
		from Seattle
Syracuse	118.15	16.05
Columbus	88.55	12.80
Cincinnati	83.60	12.25
New Haven	140.02	18.10
		from N.Y.
New Orleans (via St. Louis)	77.80	14.30
Albany	150.70	17.55
San Francisco	80.65	15.40
Chicago	60.40	10.65
Indianapolis	75.50	11.55
Spokane	71.60	15.80
Des Moines	40.10	8.30
Wichita	31.70	5.80
Kansas City	36.90	6.55
Winnipeg	77.45	14.95
Boston	148.86	19.00
Memphis (via St. Louis)	65.05	10.65
Dayton	84.30	12.80
Detroit	85.85	12.80
Minneapolis	51.90	9.95
Montreal	125.15	18.10
Omaha	31.35	6.55

	Railroad Round-Trip	Lower Berth One-Way
New York	$138.10	$ 18.10
Newark	137.55	18.10
Dallas	48.60	8.90
Tulsa (via K.C.)	47.50	6.55
		from K.C.
Cleveland	90.55	13.80
Greensboro, N.C.	112.95	18.95
Oklahoma City	41.70	8.30
Toronto	101.50	15.40
Ottawa	119.25	18.10
Seattle	83.85	14.80
Philadelphia	130.40	17.55
Pittsburgh	100.90	14.30
Sacramento	80.65	14.30
St. Louis	55.15	9.95
Shreveport	59.85	10.95
Houston	60.95	11.55
Los Angeles	80.65	15.40
Charlotte	109.45	18.25
San Antonio	62.95	12.25
Salt Lake City	34.45	7.60
Norfolk	130.75	17.55
Washington	125.95	16.60
Grand Rapids	77.08	12.80
Buffalo	105.45	15.40
Milwaukee	61.50	10.65
		from Chicago

†Tax not included.

1953 EDITION OF THE GUIDE

PROMINENT features of the 31st edition of the HEATING VENTILATING AIR CONDITIONING GUIDE are a new section on snow melting, completely rewritten chapters on electric heating and industrial exhaust systems, and a new chapter on water vapor and condensation in building construction. New information has been added on industrial oil and gas burners, short chimneys, industrial degree-days, warm air system design, and unit heaters, and a general improvement is noted throughout the book.

The Technical Data Section has been increased by 32 pages to a total of 1096 pages — the largest to date. The Manufacturers' Catalog Data Section has also been enlarged to 127 pages.

The material of previous editions has been retained with condensation wherever possible to permit addition of recently available information.

Important changes in THE GUIDE, 1953, are:

Water Vapor and Condensation in Building Construction are treated in a separate chapter with new data added to previous information.

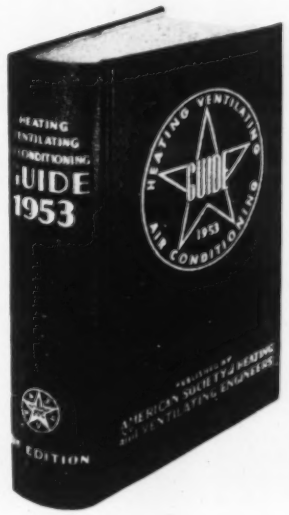
A section on snow melting installation and snowfall data for U. S. cities is new, and has been added to the chapter on *Panel Heating*.

The chapter on *Industrial Exhaust Systems* is completely rewritten with the addition of new tables and diagrams for the design of exhaust hoods and piping. Recommendations of the *American Conference of Governmental Industrial Hygienists* are included.

Electric Heating is treated in a rewritten chapter covering present accepted practice in electric space heating and hot water service.

Latest improvements of warm air gravity and forced circulation systems are described in the chapters on *Warm Air Systems*.

Heat losses from floor slabs, and perimeter heating systems are covered



in new material in the chapter on *Heating Load*.

Simplified cooling load calculations, discussions of radio-active contaminants, a revised friction chart for copper tubing, an enlarged list of codes and standards pertaining to heating, ventilating and air conditioning, and many other improvements are important changes found in this edition.

The 51 chapters of THE GUIDE are grouped in seven sections of related chapters under the following headings:

I—*FUNDAMENTALS*: Terminology, Abbreviations and Symbols, Thermodynamics, Fluid Flow, Heat Transfer; II—*HUMAN REACTIONS*: Physiological Principles, Air Conditioning in the Prevention and Treatment of Disease, Air Contaminants; III—*HEATING AND COOLING LOADS*: Heat Transmission Coefficients of Building Materials, Water Vapor and Condensation in Building Construction, Infiltration and Ventilation, Heating Load, Cooling Load; IV—*COMBUSTION AND CONSUMPTION OF FUELS*: Fuels and Combustion, Automatic Fuel Burning Equipment, Heating Boilers, Furnaces, Space Heaters, Chimneys and Draft Calculations, Estimating Fuel Consumption for Space Heating; V—*SYSTEMS AND EQUIPMENT*: Gravity Warm Air Systems, Forced Warm Air Systems, Steam Heating Systems, Hot Water Heating Systems, Radiators and Convectors, Panel Heating, Unit Heaters and Unit Ventilators, Unit Air Conditioners and Unit Air Coolers, Pipe Fittings, Welding, Pipe Insulation, District Heating, Central Systems for Air Conditioning, Air Distribution, Air Duct Design, Fans, Air Cleaning, Spray Apparatus, Air Heating and Cooling Coils, Refrigeration, Dehumidification by Sorbent Materials, Automatic Control, Motors and Motor Controls, Sound Control, Electric Heating, Corrosion and Water Formed Deposits—Causes and Prevention, Owning and Operating Costs; VI—*SPECIAL SYSTEMS*: Industrial Air Conditioning, Industrial Exhaust Systems, Industrial Drying Systems, Transportation Air Conditioning, Water Services; VII—*INSTRUMENTS AND CODES*: Instruments and Measurements, Codes and Standards.

The ASHVE Psychrometric Chart is included separately in large size, 24 x 32 in. and is printed in two colors to facilitate the solution of problems involving air. This chart is based on the most widely accepted data on the properties of moist air tabulated in the chapter on *Thermodynamics*.

The 31st edition was prepared by the Guide Committee, composed of: B. H. Jennings, *chairman*, P. R. Achenbach, D. B. Anderson, R. E. Cherne, W. S. Harris, W. E. Long, A. B. Newton, F. J. Nunlist, Jr., C. D. Shields, I. W. Cotton, *ex-officio*, and Carl H. Flink, *technical secretary*.

Catalog Data Section

Specifications and data indicating the latest products of 305 manufacturers are found in the Catalog Data Section which includes a 32-page Index to Modern Equipment. This section serves as a convenient reference for sources of equipment needed by designers and contractors.

A comprehensive Index to the Technical Data Section is also included.

THE GUIDE is 6 x 9 in. in size, bound in blue cloth cover, stamped in gold, and is similar in appearance to previous editions. The price of single copies of this edition is $7.50.

April Conferences Planned

Basic Odor Research Correlation Conference

A TWO-DAY Conference on *Basic Odor Research Correlation*, under the joint sponsorship of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and The New York Academy of Sciences, will be held on April 23 and 24, 1953 at the Barbizon-Plaza Hotel, New York City.

The *odor problem* is of serious concern to chemists, physicists, experimental psychologists, as well as to industrial scientists working in the fields of cosmetics, tobacco, food, and the manufacture and transportation of chemical products. In arranging this Conference, THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and The New York Academy of Sciences will bring together outstanding investigators in academic and industrial laboratories, working in these special fields, to explore jointly the present status and recent developments, with the hope that a full exchange of knowledge and opinions with their colleagues in allied fields will benefit all those concerned with the basic odor problem.

The ASHVE has directed extensive research to the problem of odors in air conditioned spaces. They report that conditioned air, far from being *free* is costly to the degree that energy has been devoted to its heating, cooling and cleaning, and hence must be conserved as far as possible in the interests of economy. It has been established that when conditioned air is recirculated within an occupied space, it takes up odors from people, furnishings, foods, tobacco and other substances. Questions relating to the perception of such odors, the effects of environmental factors on their intensity, and methods for their control are of fundamental interest to the air conditioning, heating, refrigeration, and ventilating industries.

Dr. Albert R. Behnke, United States Navy, will preside as general chairman. Introductory remarks by Thomas H. Urdahl, consulting engineer, Washington, D. C., and chairman, ASHVE TAC on Odors, will present *The Odor Problem in Industry and Sciences*. The various sessions have been arranged to take up various phases of the problem.

The morning session on Thursday, April 23, will be under the chairmanship of A. B. Hubbard, Air Conditioning Division, General Electric Co., and will cover the general subject *The Odor Problem in Industry and Sciences*. This will be broken down into two sections, *Basic Types of Industrial Odor Problems* and *Problems of Odor Research from the Viewpoint of the Scientist*.

The general theme of the afternoon session, Thursday, April 23, will be *The Olfactory Process, Status of Present Knowledge*. This will present the views of five outstanding doctors, chemists and physiologists. Dr. Amos Turk, director of research, Connor Engineering Corp., will preside at this session.

The Thursday evening session will be a continuation of the afternoon program. Three speakers from Arthur D. Little, Inc., will be heard, discussing *An Information Theory of Olfaction*. The session will close with a discussion of all the papers presented during the afternoon and evening sessions.

The second morning session, Friday, April 24, will have for its theme *The Status of Subjective and Objective Measurement Techniques* and will be chairmanned by Dr. Haldane Gee, director of bacteriology and toxicology, Foster D. Snell, Inc. The speakers will include prominent men from several industrial and research organizations. The luncheon speaker will be W. E. Reynolds, commissioner of public buildings, General Services Administration, Washington, D. C.

The subject of the afternoon session, Friday, April 24, will be *Experimental Studies in Odor*. George W. Meek, consulting engineer and member of the TAC on Odors of the Society will preside. The speakers will be research men from Purdue, Northwestern and Pittsburgh Universities and Tufts College.

The Odors Conference Committee will be composed of the following men: T. H. Urdahl, W. N. Witheridge, Dr. L. H. Beck, Dr. N. E. Berry, Dr. V. G. Dethier, W. A. Grant, A. B. Hubbard, G. W. Meek, Dr. Sherman Ross, Dr. R. G. H. Siu, Dr. Amos Turk, all members of the Society's TAC on Odors, and Hilary Koprowski, M. J. Kopak and Dr. Haldane Gee.

All interested members of the ASHVE are invited to attend the sessions of the Conference. A complete program of the meeting listing all the speakers and their subjects was sent to Chapter secretaries for announcement to the members at March and April meetings.

Residential Air Conditioning Conference at Lehigh

Recognizing the growing importance of year-round residential air conditioning, and to focus attention on immediate and future needs, a Conference on *Residential Air Conditioning* will be held at Lehigh University, Bethlehem, Pa., on April 24 and 25, 1953.

Representatives from the *National Association of Home Builders*, the *Building Research Advisory Board of National Research Council*, the *National Warm Air Heating and Air Conditioning Association*, THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, the *American Society of Refrigerating Engineers*, the *American Society of Mechanical*

gineers, the *National Mineral Wool Association*, and *Air Conditioning and Refrigerating Machinery Association*, have cooperated with J. V. D. Eppes, associate professor of mechanical engineering, Lehigh University, in planning the program for this Conference.

The Conference will be of particular interest to people in research groups and laboratories, colleges and universities, engineering societies and trade associations, and manufacturing and engineering concerns.

Registration will begin on Friday morning, and Dr. M. D. Whittaker, president, Lehigh University, will open the Conference. There will be a nominal fee for registration.

Among the subjects for Conference discussion are the essentials of modern residential construction, current research in heating and air conditioning residences, load calculations, actual and calculated loads, air conditioning control, and future research and development projects.

The Conference will terminate at 12:30 p.m. on April 25, 1953.

Hotel accommodations will be available at Hotels Bethlehem and American in Bethlehem, and Hotels Traylor and Americus in Allentown.

*Summary of Chapter Meetings**

North Jersey Becomes Society's Newest Chapter at Charter Meeting

Head table group at charter meeting of North Jersey Chapter *(left to right)* A. V. Hutchinson, C. H. Smith, W. L. Fleisher, A. A. Bearman, H. M. Patrick, E. R. Queer, F. H. Faust, E. T. Best, A. J. Offner, W. C. Kruse, Jr., P. B. Gordon, O. O. Oaks, M. E. Barnard

The Chapter was honored at its January meeting to formally receive its Charter from Prof. E. R. Queer, director, Department of Engineering Research, The Pennsylvania State College, State College, Pa., who made the presentation on behalf of Society Pres. Ernest Szekely. Among the distinguished guests at the meeting were Society Past Presidents W. L. Fleisher and A. J. Offner, who spoke briefly on *The Objectives of the ASHVE and the Value of Membership* and *The Chapters' Function and Their Value*, respectively. In addition, P. B. Gordon, member of Council and president of the New York Chapter, spoke on *Chapter Relations*.

Pres. F. H. Faust presided at the meeting. Professor Queer, in addition to making the Charter presentation, gave a talk entitled *Condensation Problems in Modern Buildings*, which was very well received. He outlined the causes of condensation and methods of correcting them. A discussion period followed his talk. The meeting was adjourned after a short resume of future Chapter meeting programs was presented by H. M. Patrick, program chairman. Attendance 107.

Prof. E. R. Queer *(left)* presenting charter to F. H. Faust, president of North Jersey Chapter

• *ATLANTA:* Harold Sterrett, Southern Zonolite Co., the speaker of the evening, spoke on *Vermiculite and Its Uses in the Building Field.* Mr. Sterrett illustrated his talk with a movie and an actual demonstration.

The February meeting was called to order at Mammy's Shanty Restaurant by Pres. J. G. Croley, and the minutes of the January meeting were read and approved. A report was then made by J. M. Lazenby, chairman of the by-laws committee, who announced that the Chapter by-laws had been completely revised using the by-laws prepared by the Society's Council as a model. Attendance 45. Attendance ratio 0.41.

• *ATLANTA:* L. L. Barnes introduced the speaker of the evening, H. D. Humphreys, vice president of the *Associated General Contractors,* who spoke on *Responsibilities of Mechanical Trades as Applied to General Contractors.*

The January meeting was presided over and called to order by Pres. J. G. Croley following the social hour and dinner. The minutes of the previous meeting were read and approved, after which President Croley announced the appointment of the following committee chairmen: *finance* — Peter Van Dae, Jr.; *membership* — J. M. Lazenby; *program* — J. A. Marshall; *codes* — S. W. Boyd and G. B. Hightower; *publication* — J. N. Voorhees; *house and social* — W. M. Garrard and Leo Sudderth, Jr.; *attendance* — J. J. O'Shea; and *research* — H. K. McCain. Attendance 35. Attendance ratio 0.35.

• *BALTIMORE:* G. W. Meek, consulting engineer, New York, N. Y., gave a talk on *Odors and Their Interest to Air Conditioning Engineers,* which he illustrated with slides. Mr. Meek stated that the usual solution to the odor problem was the introduction of additional outside air which increases the requirements of an air conditioning system. After several years of research on smell there are many theories on how the sense of smell functions. With no yardstick, all measurements must be made by the human nose, and there is a definite psychological factor in using this standard. Mr. Meek outlined the work being done at the Society's Research Laboratory, Northwestern University Medical School and Wheeler Research Laboratory. The discussion following Mr. Meek's talk brought out the importance of relative humidity, odorants, odor intensity due to molecular activity, and that country air is not necessarily free of odors.

Vice Pres. H. D. Glaser called the February meeting to order in the Engineers Club. E. S. Berngartt introduced the speaker. Attendance 37. Attendance ratio 0.33.

• *CENTRAL OHIO:* Galen F. Oman, architect, presented an interesting discussion on what the architect looks for in a heating plant. Mr. Oman followed his talk with a series of slides taken on his recent trip to the Olympic games in Finland with side trips to several other European countries.

The February meeting was presided over by Pres. A. D. Bogen, who discussed the Chapters Conference Committee meeting in Chicago. Attendance 32. Attendance ratio 0.26.

• *CINCINNATI:* H. W. Moore introduced the coffee speaker, Jack Dudley, of the Cincinnati Enquirer, who gave an interesting talk on the business outlook for the next four years.

Following the coffee talk, members and guests adjourned to the auditorium to hear H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., give a talk on various phases of panel heating.

Pres. H. E. Russell called the February meeting to order and the minutes of the previous meeting were read and approved. Attendance 32. Attendance ratio 0.29.

• *CINCINNATI:* The annual joint meeting of the local *ASRE* section and the ASHVE was held on January 22, with Pres. Joseph Aquato of the *ASRE* presiding. The after-dinner speaker was Dr. C. A. Mills of the University of Cincinnati, who spoke on the heating and cooling of his home, *Reflection Point,* by radiant panels. A question and answer period followed Dr. Mills' talk.

The guest speaker was J. C. Woodson, assistant sales manager, Heat Pump Department, General Electric Co., who spoke on the development of the heat pump and its applications. Attendance 52. Attendance ratio 0.43.

• *CONNECTICUT:* The January meeting was called to order by Pres. T. L. Arnold at the Three Cups Inn, Meriden, Conn. The speaker, H. A. Wright, technical consultant, Herman Nelson Division, American Air Filter Co., New York, N. Y., spoke on *Fundamentals of School House Heating and Ventilating.* Attendance 40.

• *EMPIRE STATE CAPITAL:* The February meeting at which members and guests were introduced was presided over by Pres. Harry Horowitz. At this meeting, R. B. Taylor was appointed chairman of the nominating committee.

The guest speaker was O. L. Wood, General Electric Co., who discussed *Mercury Power Plants,* their background, and operating costs as compared to steam. He also discoursed on the uses, history and properties of mercury. A question and answer period followed his interesting talk. Attendance 22.

• *EMPIRE STATE CAPITAL:* N. W. Burrill introduced the guest speaker, W. N. Murray, Eastern division sales manager, Herman Nelson Division, American Air Filter Co. Mr. Murray spoke on air distribution and its behavior in the modern school

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

room. He used colored slides to illustrate his talk. A short question and answer period followed.

The January meeting was called to order by Pres. Harry Horowitz at Panetta's Restaurant. After individual members and guests identified themselves, the minutes of the December meeting and the treasurer's report were read. Attendance 31.

• *GOLDEN GATE:* The first part of the February meeting consisted, in large part, of reports and announcements. The following committee chairmen were heard from: C. B. Smith — *membership;* J. B. Smith — *attendance;* D. A. Delaney — *reception;* E. F. Dill — *technical;* H. R. Scandrett — *finance;* F. K. Crouch — *legislative;* A. D. Sheere — *publicity.* In addition Vice Pres. J. E. Murray, presiding officer, read a letter inviting members to attend the 8th Oregon State Air Conditioning Conference, sponsored by Oregon Chapter of ASHVE.

The guest speaker for the program was E. W. Howes, who spoke on the heat pump and presented a practical demonstration of the equipment. Attendance 61.

• *GOLDEN GATE:* The guest speaker at the January meeting was James Caldwell, Allis-Chalmers Manufacturing Co., who spoke on centrifugal pumps. His talk was followed by a question and answer period.

The meeting was presided over by Pres. T. J. White, who presented several Committee chairmen who in turn presented their reports. Letters from J. E. Haines, chairman of the Society's Membership Committee, concerning the Golden Gate Chapter's by-laws, and a letter from L. A. O'Meara, president of the Sacramento Valley Chapter were read. In answer to his question, H. F. McCandless was informed that provisional chapters, such as that proposed for Fresno, were under discussion by the Council. Attendance 51.

• *ILLINOIS:* Pres. M. W. Bishop opened the meeting at the Merchants & Manufacturers' Club, Chicago.

Prof. M. K. Fahnestock, of the University of Illinois, spoke of the work of the University on residential heating and air conditioning. He then introduced Prof. R. W. Roose and several other members of the University of Illinois faculty who were present.

E. R. Teske then introduced two speakers, R. T. Hansen of Acme Industries and L. M. Larkin of General Electric Co., who talked on *Residential Air Conditioning.* Mr. Larkin, regional manager of central division, Air Conditioning Division of G-E, described some of the new types of equipment offered for residential air conditioning and predicted this year will mark the beginning of a complete revolution in the marketing of packaged heating and air conditioning equipment. Mr. Hansen discussed the technical and design aspects of residential air conditioning. He also mentioned the fact that today a variety of equipment is available. Attendance 132. Attendance ratio 0.22.

• *ILLINOIS:* The relative merits of boiler ratings used by manufacturers of packaged steam generators and the *Steel Boiler Institute* ratings used by manufacturers of steel heating boilers were the highlights of the January 12 debate before more than 250 members and guests of the Illinois Chapter.

According to C. V. Anderson, chief engineer, Cleaver-Brooks Co., a peak load rating based on 5 to 6 sq ft of heating surface per boiler hp is satisfactory for selecting a packaged generator. With the knowledge that a load rating is used, the engineer selecting the generator can easily make his own allowances for piping losses, pickup, future plant or building changes and expansions, etc.

On the other hand, J. R. Collette, vice president, Fitzgibbons Boiler Co., argued that *SBI* boiler ratings, which are based on 8.2 sq ft of heating surface per boiler hp, provide a much needed safety factor. He pointed out that a steel heating boiler selected in accordance with the *SBI* rating can handle 150 percent of the recommended load and can be operated continuously at 125 percent of the recommended load. In his opinion, the *SBI* rating code has been time tested during the last 20 years and has proved to be the most suitable method of rating steel boilers.

In his lead-off remarks, Mr. Anderson defined a packaged steam generator as a self-contained steam boiler incorporating the boiler, boiler trim, fuel burner, and burner controls. In addition, he said, the unit may include the boiler return system, insulation and lagging. Pressure atomizing and rotary oil burners, as well as gas burners are frequently used and available sizes were said to range from 15 to 2000 hp. Advantages which he cited included relatively high efficiencies (approximately 80 percent) from 30 to 100 percent of full load and the fact that natural draft chimneys are not required.

Mr. Collette opened his remarks by saying that he has no quarrel with the principle of the packaged steam boiler, though he does quarrel with the method of rating. He predicted changes in the design and marketing of packaged units.

The advantages of steel heating boilers which Mr. Collette stressed were: adaptability to any fuel; ease of cleaning, with all boiler tubes readily accessible; the fact that all water surfaces can be flushed from cleanout openings; while designed for natural draft, units will operate very successfully with induced draft; the purchaser can choose the make of burner — one that is widely sold in his community and for which good service is avilable. It was also pointed out that efficiencies of 80 percent are not beyond the capabilities of steel heating boilers.

• *INDIANA:* The Chapter was honored at its January meeting to have as its guest, ASHVE Second Vice Pres. L. N. Hunter, vice president, Research, The National Radiator Co., Johnstown, Pa., who was introduced by G. B. Supple. Mr. Hunter spoke on *Rating of Heating Boilers.* He presented a brief but

enlightening summary of the history, purposes and results of the various boiler rating codes now in use.

During the business meeting, conducted by Pres. J. T. Hardin, three phases of Chapter activity in need of improvement were noted as follows: attendance at meetings, obtaining new members, and the Chapter's research project. President Hardin urged the members to apply themselves to these tasks. Attendance 37.

• *INLAND EMPIRE:* The February meeting, presided over by Pres. T. P. Nau, opened with reports from the secretary and the treasurer. It was announced that Reg F. Taylor, president of the Society, would visit the Chapter on March 16. The evening program was a panel discussion with H. A. Bickel as moderator, and L. E. Marque, K. M. Wood, G. C. Murray and E. W. Bunnell serving as panel experts. Written questions by the Chapter members sparked some lively discussions. The Chapter members were invited to attend the 8th Oregon State Air Conditioning Conference, March 18, 19 and 20. Attendance 26.

• *INLAND EMPIRE:* A. J. Hess, member of the Society's Chapter Relations Committee, and president, Hess-Greiner & Polland, Los Angeles, presented an interesting talk on the Society's Research Laboratory, and the research projects now being conducted. Mr. Hess illustrated his talk with slides.

Pres. T. P. Nau called the January meeting to order after which F. W. Jenkinson, treasurer, made his report. Attendance 18. Attendance ratio 0.40.

• *KANSAS:* Following a social hour and dinner, Vice Pres. R. L. Pennington, presiding officer, called the February meeting to order, and the minutes of the January meeting were read and approved.

The speaker of the evening was A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif. Mr. Hess' talk was on the subject of *The Heat Pump* and was followed by a discussion period. Attendance 33. Attendance ratio 0.34.

• *KANSAS:* Lewis Smith of C. A. Dunham Co., New York, N. Y., was introduced as the speaker of the evening by Pres. O. P. Bullock. Mr. Smith spoke on the subject, *Heat Control — Sub-Atmospheric Steam*, and a general discussion period followed his talk.

The January meeting was called to order by President Bullock, and preceding the address of the evening, a discussion was held relative to the Kansas Chapter's membership in the *Wichita Technical Society*. A motion was made and seconded that the Chapter become a member of the *Wichita Technical Society*. Attendance 56. Attendance ratio 0.20.

• *KANSAS CITY:* Dr. Norman N. Royal, Jr., Dean of the College of Liberal Arts, Kansas City University, spoke on the relationship of engineers to society with particular emphasis on free inquiry and restrictions brought about by fear of Communism; and also the engineer's place in the present day scheme of life.

A letter was read from T. R. Wiley, chapter member, relative to vocational guidance in schools. Mr. Wiley's letter mentioned the possibility of the chapter serving as a Vocational Guidance Agency for some of the schools in the area insofar as sales, contracting and consulting were concerned. Another letter, this one from the Corps of Engineers, was read. This dealt with the recruiting of professional men for overseas assignments.

The December meeting was called to order by Pres. W. A. Reichow at the Wishbone Restaurant. Attendance 60. Attendance ratio 0.25.

• *KANSAS CITY:* Vice Pres. G. H. Stoffer introduced the guest speaker, Lewis Smith, C. A. Dunham Co. Mr. Smith spoke on the use of steam heating in a number of large housing projects throughout the East. He indicated the methods which would be followed in the use of high vacuum to maintain low temperature steam and uniform temperatures throughout the system. A question and answer period followed the talk.

In the absence of E. E. Ralston, J. E. Miller reported on the progress made by the Membership Committee on the campaign for obtaining new members. He discussed methods of securing application blanks, and submitting applications for membership in the Society as well as for the local chapter.

Pres. W. A. Reichow called the January meeting to order at the Wishbone Restaurant. Attendance 82. Attendance ratio 0.34.

• *MASSACHUSETTS:* The January meeting of the Chapter was highlighted by a talk given by H. A. Wright, technical consultant, Herman Nelson Division, American Air Filter Co., New York, N. Y., whose subject was, *The Classroom Laboratory*. He pointed out the importance of figuring the short occupancy period, the solar heat gain and heat gain from occupants in the modern school. His talk was illustrated by colored slides and followed by a discussion period. The meeting was presided over by Vice Pres. A. L. Hare, and movies of the December meeting were shown by A. I. Brayman. Attendance 10.

• *MEMPHIS:* At the January meeting, the members heard a discussion on the City of Memphis Building Code as applied to refrigeration. The speaker was Alvis Clay, of the Memphis City Building Department, who is also incoming president of the *National Association of Practical Refrigerating Engineers*. A question and answer period followed Mr. Clay's talk.

The meeting was called to order by Pres. W. L. Drake. M. H. Ellis, local Chapter representative on the Chapters Conference Committee, was instructed to back C. B. Gamble of New Orleans for the Society's Nominating Committee at the Committee's

meeting at the Annual Meeting in Chicago. Attendance 15.

• *MINNESOTA:* Dreng Bjornaraa, of the United States Steel Corp., was the guest speaker at the annual joint meeting of the local Chapters of the ASHVE and *ASRE*. Mr. Bjornaraa's interesting talk, *The Iron Ore Industry*, was accompanied by a movie showing Minnesota's part in this vital industry.

Several announcements were made concerning privileges of belonging to the *Minnesota Federation of Engineering Societies* as individuals, and the Third Midwestern Conference on Fluid Mechanics to be held at the University of Minnesota, March 23-25, 1953. The January meeting was called to order by Pres. William Sturm, who introduced the Chapter officers of the ASHVE and L. J. Krause and D. H. Oliver, president and secretary, respectively, of the Twin City Section of *ASRE*.

• *MINNESOTA:* The December meeting of the Chapter was presided over by Vice Pres. V. E. Pearson in the absence of Pres. William Sturm, who was ill. The reports of the secretary and treasurer were received, and by unanimous vote, President Sturm and Vice President Pearson were elected member and alternate member, respectively, on the Chapters Conference Committee. J. E. Haines, nominee for the office of second vice president of the Society, was introduced and he urged the members to attend the 59th Annual Meeting and the 11th International Heating and Ventilating Exposition in Chicago.

W. R. Alexander, Carrier Corp., presented an enlightening talk, *High Velocity Air Distribution Systems*. Attendance 79.

• *MONTREAL:* Pres. W. G. Hole, who presided at the February meeting, reported on the 59th Annual Meeting and noted the excellent attendance from Canada, and the selection of H. G. S. Murray by the Chapters Conference Committee as a member of the Society's Nominating Committee.

J. G. Chenevert presented a report of nominations for officers for the coming year.

The speaker, Bernard Beaupre, smoke control engineer, City of Montreal, was introduced by D. J. McIntyre and spoke on *Smoke and Air Pollution in Montreal*. He outlined the present smoke control law, its operation, and how it is applied. He stated that the greatest offenders in the city are the incinerators. Attendance 63.

• *MONTREAL:* With J. D. Ross as moderator, a panel discussion was held on *Specifications* with the following members serving on the panel: T. E. Cockman, F. J. Friedman, H. G. S. Murray, T. D. O'Connell and W. W. Timmins. In addition, Frank LaFrancois and Robert Montgomery also took part in the panel. The ensuing discussion brought out that while clear cut specifications were most desirable for contractors, they worked the greatest hardship on suppliers.

The January meeting was called to order by Pres. W. G. Hole, who spoke on the forthcoming 59th Annual Meeting in Chicago. The reports of the secretary and treasurer were presented.

• *NEBRASKA:* The annual stag party of the Chapter, held at the Castle Hotel, was sponsored by past presidents of the Chapter. Following dinner, entertainment was presided over by the past presidents. S. W. Black, chapter president, presided over the January meeting. Attendance 20. Attendance ratio 0.35.

• *NEW YORK:* Pres. P. B. Gordon, presiding at the February meeting, announced that three members, Leonard Greenburg, Commissioner, Carl F. Kayan, and R. A. Wolff, had been appointed to the New York City Board of Air Pollution by the Mayor. He also congratulated the Christmas Party Committee for their successful program. The Chapter has contributed $100 to the M. C. Giannini Memorial Fund of New York University, as a tribute to his outstanding service to the New York Chapter and the Society.

The guest speaker, R. D. Tutt, chief engineer, Tuttle and Bailey, New Britain, Conn., was introduced by J. E. Schechter, program chairman. His talk, *The Principles of Air Distribution*, described the development of air outlets, and the application of various types of outlets and diffusers. He devoted considerable attention to outlets for high pressure systems which save space and material. A discussion followed the talk. Attendance 130. Attendance ratio 0.20.

• *NORTH JERSEY:* Following announcements by H. M. Patrick, program chairman, and G. C. Norman, membership chairman, Pres. F. H. Faust, who presided at the December meeting, presented a Life Membership Certificate to Harry S. Wheller, a Society member since 1916.

The guest speaker, introduced by Mr. Patrick, was W. F. Friend, mechanical engineer with Ebasco Services, New York, N.Y. His talk, *Where Does Electric Heating Stand Today*, was well received and covered the subject of electric heating very completely. The talk was followed by a question and answer period. Attendance 75.

• *NORTH TEXAS:* The members of the Chapter were honored at their January meeting by having as their guest, Reg F. Taylor, first vice president of the ASHVE. Mr. Taylor, with appropriate comments, presented past presidents' pins to L. S. Gilbert, T. H. Anspacher, E. T. Gessell, E. J. Stern, C. Rollins Gardner, G. A. Linskie, and R. E. Allison.

Reports of the treasurer, program and hospitality committees were presented. The new committee chairmen were introduced and commented briefly on their plans for the coming year. H. G. Gregerson, the Chapter's representative on the Chapters Conference Committee, was given the

members' opinions on the business to come up at the Committee's meeting in Chicago. Pres. P. N. Vinther presided. Attendance 75. Attendance ratio 0.42.

• *NORTHEASTERN OKLAHOMA:* The February meeting was held in the Hotel Tulsa and the program portion was held jointly with the *Tulsa Housebuilders Association.*

Vice Pres. V. W. Miles announced the speaker for the evening, C. W. Nessell of the *National Warm Air Heating and Air Conditioning Association.* Mr. Nessell is chairman of the Field Investigation Committee sponsored by the *Association* and his talk was based upon the facts brought to light by the activities of his committee in testing winter and summer air conditioning installations in Dallas and Houston during the past summer. Attendance 29. Attendance ratio 0.42.

• *NORTHEASTERN OKLAHOMA:* The January meeting was conducted by newly elected Pres. J. N. Watt who announced the names of the committee chairmen as follows: *program* and *publicity*—J. D. Ryan; *meeting* and *attendance*—G. A. McCune; *research*—W. C. Roads; *membership*—V. W. Miles; and *bylaws*—L. T. Devero. The retiring treasurer, secretary and committee chairmen presented their reports.

The subject of the talk given by Messrs. Hoffman and Kaufman, Carrier Corp., was *Conduit Air Conditioning for Tall Office Buildings.* Their talks, illustrated by slides, showed a recent application as applied to the United Nations Secretariat in New York. The animated discussion following the talks attested to the interest in the subject. Attendance 41. Attendance ratio 0.57.

• *NORTHERN OHIO:* The January program featured a joint meeting with the *ASRE* local section. Local officers of both societies were introduced by Lester T. Avery. The speaker for the evening was H. E. Degler, technical director, The Marley Co., Kansas City, Mo., whose subject was *Wet Bulb Design for Air Conditioning and Cooling Towers.* His talk, accompanied by slides, showed typical condensing circuits and the effect of wet bulb temperature on tower capacity. Performance curves and cost variations based on different loads and approaches were shown.

During the business meeting several new members were introduced and Mr. Avery spoke on the organization of the *ASRE.* Attendance 89.

• *NORTHERN PIEDMONT:* Pres. J. E. Hart called the February meeting to order at the Bliss Restaurant, and the minutes of the last meeting were read and approved with a correction by W. M. Wallace, II. President Hart announced the appointment of the following committee chairmen: *auditing* and *finance*—Harry Hoffman; *program*—L. B. Hoffman; *membership*—J. M. Pleasants; and *attendance*—H. W. Powell, Jr.

F. G. Meyer, chief engineer, Marlo Coil Co., St. Louis, Mo., gave a very interesting talk on direct expansion coils and their proper selection, including home air conditioning. An informal discussion period followed the talk. Attendance 44.

• *ONTARIO:* W. R. McMahon, assistant sales manager, Modine Manufacturing Co., was the guest speaker at the February meeting of the Chapter. His talk, followed by a discussion, was entitled *Facts About Unit Heaters.*

The business meeting was conducted by Pres. J. H. Ross, and N. W. Kingsland presented a report on the Chicago meeting and commented on the large number of Canadians who attended. Attendance 100. Attendance ratio 0.34.

• *OREGON:* The February meeting was highlighted by several members' reports on the 59th Annual Meeting. J. D. Kroeker reported on the Council meeting, B. W. Farnes on the Banquet and Exposition, R. C. Chewning on the technical sessions, and A. N. Hoss on the Chapters Conference Committee meeting.

Pres. K. H. Hanson presided over the meeting. The nominating committee presented the proposed slate of officers for 1953. The following Chapter committee reports were presented: *conference*—J. D. Kroeker; *expositions*—G. C. Day; *research*—W. F. Kelly, Jr.; *membership*—J. E. Finkbeiner; *student assistance*—E. E. Kelly; and *historian*—J. P. McDermott. Mr. Kroeker then urged Chapter members to be active in the Society and volunteer to work on the various TAC's. Attendance 57. Attendance ratio 0.32.

• *OTTAWA VALLEY:* R. A. Van Berkum, district representative, Bailey Meter Co., presented a talk on *Power Plant Operation,* in which he pointed out the importance and advantages of automatic meters, controls and instruments. He explained the resultant economies and safety features as well as the improvement in boiler firing, steam output and water usage.

The January meeting was called to order by Vice Pres. G. L. Ostiguy in the absence of the president. Guests were introduced and the reports of the treasurer and secretary were read. The speaker was introduced by J. S. Massiah. Attendance 26.

• *PACIFIC NORTHWEST:* At a joint dinner meeting of the ASHVE and *ASRE,* the former Chapter acting as host, A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., was presented as the guest speaker. Mr. Hess, by turns serious and humorous, spoke on objectives of technical societies, research, optimists, pessimists and color blindness.

During the February business meeting, called to order by Pres. W. B. Pride, the Chapter voted to contribute $.40 per capita to the Puget Sound Engineering Council. A minute of silence was observed for F. C. Culver, who died on February 5, 1953. It was voted to have the secretary select and purchase an en-

gineering volume for the library in his memory. Attendance 80.

• *PACIFIC NORTHWEST:* Pres. W. B. Pride introduced the speaker of the evening, P. L. Geiringer, president and chief engineer of American Hydrotherm Corp., New York, N.Y. Mr. Geiringer spoke on *High Temperature Water Heat Distribution Systems* and illustrated his excellent talk with slides. The talk was followed by a short discussion period.

President Pride called the January meeting to order at 7:30 p.m. and introduced visiting guests who included personnel of the Army Engineers, Air Force, and the U. S. Navy from San Francisco, Walla Walla and Portland. Attendance 125.

• *PHILADELPHIA:* Pres. M. E. Barnard presided at the annual January meeting of the Chapter held at the Engineers Club in Philadelphia. As this was the entertainment meeting, no business was conducted. Attendance 200.

• *PITTSBURGH:* The February meeting was held at Webster Hall, and Pres. B. B. Reilly made an announcement of the death of H. J. Eagen.

Mr. Reilly also brought up the question of inviting the Society to hold its 1958 meeting in Pittsburgh. After some discussion, the members voted to extend this invitation to the Society.

C. H. Schneider introduced the speaker of the evening, J. E. Robles, consulting and application engineer for Westinghouse Electric Co. His subject was *The Application of Motors and Motor Controls in the Heating, Ventilating and Air Conditioning Industries.*

In his talk on motors in general, Mr. Robles used drawings of the different steps and how they are controlled. He spoke of the single phase system which is used in the residential appliances, to the three phase for industrial use, and then on to four wire systems used chiefly in the urban districts for lighting and power. He spoke on circuit breakers in general in connection with his different motors. After going over the different phases of motors and starters, he showed a movie on the application of taking care and finding out how to locate trouble on jobs. Attendance 47. Attendance ratio 0.83.

• *ROCKY MOUNTAIN:* The January meeting was held in the Albany Hotel, Denver.

Fred Janssen announced that chairmen had been selected for the various committees which will make arrangements for the forthcoming Semi-Annual meeting of the Society in Denver.

Pres. N. H. Brickham introduced the speaker of the evening, Robert Peterson, who brought out problems confronting the contractor in executing plans and specifications governing mechanical construction. Among many points placed before the meeting was the need for mechanical supervision on many types of jobs where it is now lacking. Attendance 36.

• *SACRAMENTO VALLEY:* The meeting was called to order at the Coral Reef, Sacramento. D. R. Blanchard reported that three applicants have recently been accepted — E. B. Green, W. W. Kline and J. E. Valengano.

H. D. Brainard presented the speaker of the evening, Sheldon Doolittle of L. A. O'Meara's office, who gave an excellent talk on *Corrosion in Pipes.* Twenty-four million tons of metal worth six billion dollars are lost annually in this country because of corrosion. Mr. Doolittle told of several methods of combating corrosion.

Mr. Brainard next introduced Peter Kraljev, electrical engineer from the local U. S. Engineers Office. Mr. Kraljev discussed the various standard voltages and what they mean to the mechanical man in his selection of suitable motors. Three phase transformer connections and the resultant voltages were explained.

E. C. McKinsey spoke of having a question box at the next meeting and invited the members to submit their problems for discussion. Attendance 47. Attendance ratio 0.46.

• *ST. LOUIS:* H. C. Sharp, program committee chairman, introduced the guest speaker, A. H. Baum, St. Louis Building Commissioner, whose talk, *The St. Louis Building Code* as it applies to heating, ventilating and air conditioning design and installation engineers, outlined the code and how it promoted safety in buildings. Three of his department members ably assisted Mr. Baum during the question and answer period following the talk.

The January meeting was called to order by Pres. C. H. Burnap who introduced several of the committee chairmen for their reports, and the reports of the treasurer and the secretary were also presented. B. L. Evans urged all members to attend the 59th Annual Meeting and the Exposition to take place in Chicago. Attendance 56. Attendance ratio 0.30.

• *SOUTH TEXAS:* Society First Vice Pres. Reg F. Taylor presented to the members an outline of the technical sessions and other activities to take place at the 59th Annual Meeting. D. M. Mills was introduced by Pres. C. L. Fleming, who presided at the January meeting, and announced plans for the special train to the Chicago meeting.

The guest speaker, Robert Cummings, manager, Contract Sales Department, Sarcotherm, was introduced by C. J. Glanger. Mr. Cummings' interesting illustrated talk on *Steam Traps* covered the several major types of traps, their operation and applications. His talk was followed by a spirited question and answer period. Attendance 63.

• *SOUTHERN CALIFORNIA:* Pres. J. S. Earhart presided at the December meeting. Captain Burt, Corps of Engineers, United States Army, gave a brief and inspiring talk on his experiences in Korea.

During the business meeting, President Earhart and L. B. Davenport were elected member and alternate member, respectively, to represent the Chapter on the Chapters Conference Committee. A codes and standards committee, W. A. Strain, chairman, and auditing committee, Maron Kennedy, chairman, were also appointed.

The main speaker was R. E. Phillips who gave an amusing account of his recent trip to Europe. Attendance 103.

• *SOUTHWEST TEXAS:* The meeting was held in the Manor Tea Room, San Antonio. W. J. Brinkmann commented on the cooperation that air conditioning contractors were receiving from the city of Austin. A. C. Leske of San Antonio reported the contractors of that city were still experiencing difficulty in getting utility service and a special committee to make future investigation was appointed by the Chapter.

Pres. D. E. Locher introduced the speakers of the evening. Gary Fruechtinicht and Herman Hoffman of the Carrier Corp. collaborated to present an interesting talk on *High Pressure Duct Systems.*

Mr. Fruechtinicht's presentation covered the problems of conditioning multi-story buildings. With the assistance of slides the effects of height and wind pressures were illustrated.

Mr. Hoffman emphasized the trend to greater glass areas reflecting higher solar heat gain and greater artificial lighting loads, pointing out that cooling is required in some zones of the United Nations building when the outside temperature is as low as 40 F. Attendance 39.

• *VIRGINIA:* The meeting was held in the private dining room at the Candlelight Club, Norfolk.

The nominating committee's slate of officers was unanimously elected and was as follows: *president*—E. D. Duval; *vice president*—H. E. Marquart; *secretary*—T. B. Carpenter; *treasurer*—F. R. Ervin. R. L. Burton, Jr. and C. G. Conaway, Jr., were elected to the board of governors.

Larry Kent, humorist, spoke briefly after a most enjoyable dinner, much to the delight of the ladies present.

• *WESTERN MICHIGAN:* The meeting was held at the Rowe Hotel in Grand Rapids.

The speaker for the evening, C. H. Burkhardt, who is the associate editor of Fuel Oil and Heat, gave a talk on *The Coming Boom in Residential Air Conditioning.* Mr. Burkhardt pointed out the many evidences of the increasingly greater residential market for air conditioning and gave figures to show the strides that have been made in the last two years. Attendance 82. Attendance ratio 0.13.

• *WESTERN NEW YORK:* The meeting was held at the University Club in Buffalo. C. W. Stone, program chairman, reported on coming March and April programs.

V. N. Harwood introduced the speaker of the evening, Hal Holtz, general sales manager, Cleaver-Brooks Co., Milwaukee. Mr. Holtz's subject was *Packaged Steam Generators with Particular Reference to the Heating Field.* His talk was illustrated with slides and covered the history and reasoning behind the packaged steam boiler and the importance it is assuming in present day steam generation. Attendance 60. Attendance ratio 0.71.

• *WISCONSIN:* Pres. T. G. Jochem of the *Engineers Society of Milwaukee* introduced the after-dinner speaker, Mayor F. P. Zeidler, who spoke on *Engineers' Civic Opportunities.* He outlined problems and policies; problems being the growth of cities outward with attendant demands for sewage, water, schools, highways, etc. Although these are engineering problems, their solution is tied up with politics, he stated. Pressure is constantly being put on civic authorities to put in new expressways, parking areas, garages, etc., each to benefit some particular group and usually to the detriment of some other group or area. The consequent lowering of ratables decreases tax income which in turn decreases the availability of tax funds to finance improvements. Mayor Zeidler concluded that engineers have a great responsibility in the planning and running of any city.

The speaker of the evening was H. G. Vogt of the Corning Glass Works. Mr. Vogt gave a brief history of the methods of producing glass and explained that there are today 65,000 formulas for making glass and about 650 types now in use. He demonstrated the temper of glass by driving a nail into a board with a piece of tempered glass. He also demonstrated the strength of glass and showed how it might be used for a piston. He showed that certain colors of glass will permit heat transfer with no light transfer, and other colors can accomplish the reverse of this. Mr. Vogt displayed glass which is a good insulator and methods of making glass a conductor of electricity by fusing metal to the back of the plate glass. He had exhibits of glass cloth, glass prisms and a high silicon heat resistant type of glass which he placed on a heated hot plate with a piece of ice placed on top of the glass and the glass did not break. A question and answer period followed Mr. Vogt's talk. Attendance 300. Attendance ratio 0.23.

• *WISCONSIN:* R. G. Koch, program chairman, introduced the guest speaker for the January meeting, Marion Hollingsworth, Jr., Research Department, Owens-Corning Fiberglas Corp. Mr. Hollingsworth's talk *Acoustics and the Air Conditioning Industry,* covered hearing conditions, noise reduction and sound insulation to reduce sound transmission within building structures. He listed the sound problems faced by the heating, piping and air conditioning engineer and how they might be analyzed, controlled and eliminated.

In the absence of Pres. J. A. Lofte, Vice Pres. N. E. Hill called the meeting to order. Announcements

concerning coming meetings and the proposed State Heating and Ventilating Code were made. Attendance 60. Attendance ratio 0.23.

STUDENT BRANCHES

• *OKLAHOMA A. & M. COLLEGE:* The January meeting was presided over by acting president, H. G. Rice. It was agreed to hold only one meeting per month until membership interest could be built up. Officers elected for the spring semester included: *president*—E. M. Todd, Jr.; *vice president*—C. L. Foley; *secretary*—R. P. Schmidt; and *treasurer*—V. O. Wagner, Jr. Attendance 8.

• *OKLAHOMA A. & M. COLLEGE:* Announcements of forthcoming campus activities were made at the February meeting, presided over by new Pres. E. M. Todd, Jr. Four members indicated their intention of attending the Oklahoma City Chapter meeting, February 9.

The guest speaker of the evening was John Churchwell, Douglas Aircraft Co., Tulsa, Okla., who spoke on the *Air Cooling System of a B-47 Bomber*. Attendance 10.

• *UNIVERSITY OF DETROIT:* The guest speaker for the evening was D. S. Falk, secretary of ASHVE Michigan Chapter. He spoke on electronic air cleaners and demonstrated a working model that gave a clear understanding of the manner in which these cleaners operate.

It was proposed and resolved that the Student Branch of ASHVE hold a table in common with *SAE* and *ASME* at the annual University of Detroit Slide Rule Dinner inasmuch as many of the members of ASHVE are also members of *ASME* and *SAE*. Attendance 11.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 125 applications for membership, including 14 student applications and 6 reinstatements; in addition 10 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by April 30, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

Arizona

SPAULDING, E. K., JR., Plant Staff Engr., Hughes Aircraft Co., Tucson. REFERENCES: A. C. Baechlin, Jr., V. J. Carns, E. F. Fisher, F. B. Gardner.

Arkansas

COMBS, R. H., Business Repr., Arkansas Louisiana Gas Co., Little Rock. REFERENCES: S. W. Beaty, R. E. Blaylock, W. S. Hyde, J. I. Menefee.

MOON, L. B., Mgr., Plbg. Dept., Arkansas Electric Co., Little Rock. REFERENCES: Morris Benkovitz, E. L. Goldstein, J. E. Mullins, Brooks Turner.

California

ANDERSON, A. S., Mgr., Htg. & Vent. Dept., Auburn Lumber Co., Auburn. REFERENCES: J. C. Hemingway, Jr., T. W. Johnston, R. J. Loughlin*, W. T. Robie*.

BARTHOLOW, D. M., Co-Partner, Knoles & Co., San Anselmo. REFERENCES: J. C. Hemingway, Jr., H. C. Little*, J. D. Mitchell, S. W. Terry.

BEATY, E. M., Indus. Gas Engr., Pacific Gas & Electric Co., Sacramento. REFERENCES: O. E. Anderson*, D. R. Blanchard, C. A. Henderlong*, L. A. O'Meara.

BOOME, ALEXANDER, Chief Engr., Skidmore, Owings & Merrill, San Francisco. REFERENCES: O. P. Crose, E. P. Heckel, S. R. Lewis, S. I. Rottmayer.

JOBE, J. B., Asst. Dist. Mgr., Johns-Manville Sales Corp., Vernon. REFERENCES: E. W. Fredrick, Jr., C. W. Hull*, Leslie Irvine*, W. T. Wright*.

MCLAUGHLIN, F. H., JR., Asst. Mgr., Refrigerating & Power Specialties Co., San Francisco. REFERENCES: E. C. McKinsey, J. E. Murray, Virgil Reed, G. M. Simonson.

POWERS, J. B., Special Repr., Johns-Manville Sales Corp., Los Angeles. REFERENCES: E. W. Fredrick, Jr., W. D. Gaches*, A. L. Sherman*, I. Stauffer*.

Colorado

BURBANK, W. V., Supvsr., Electric Appliance Service Dept., Public Service Co. of Colorado, Denver. REFERENCES: J. V. Berger, E. A. Froese, J. H. McCabe, E. J. McEahern.

HELDENBRAND, W. B., Design Engr., Robert L. Whittlesey & Assocs., Denver. REFERENCES: A. W. Cooper, J. J. Johnson, J. H. McCabe, P. C. Von Rosenberg.

SETTLE, F. T., Pres., Thermal Industrial Engrg. Co., Denver. REFERENCES: N. H. Brickham, V. J. Jenkinson, J. J. Johnson, A. S. Widdowfield.

Connecticut

HATHAWAY, C. A., Chief Engr., Air Impeller Div., Torrington Mfg. Co., Torrington. REFERENCES: W. G. Boales, R. L. Maher, D. B. Robinson, R. S. Storrs*.

Delaware

ALLERDICE, J. M., Sr. Htg. & Vent. Engr., E. I. DuPont de Nemours Co., Inc., Newark. REFERENCES: M. E. Barnard, L. M. Church, C. W. Coward, E. H. Dafter.

District of Columbia

HOLLIDAY, C. W., Sales Mgr., F. C. Clifford, Inc., Washington. REFERENCES:

S. R. Allen, W. R. Dodge, W. C. Jones, W. H. Singleton.

Illinois

†Fitch, H. M., Mgr. of Operations, American Air Filter Co., Inc., Moline. References: L. S. Churchill*, A. F. Hubbard, J. W. May, C. S. Stock.

Glocaris, R. S., Htg. & Vent. Engr., S. J. Reynolds Co., Chicago. References: W. N. Barr, Jr., E. H. Gage, R. O. Nelson, E. E. Sundeen.

Greenstein, Jerome, Design Mech. Engr., E. R. Gritschke & Assocs., Chicago. References: H. G. Gragg, E. R. Gritschke, J. W. Scharres, H. G. Swart.

Gustafson, E. H., Constr. Supt., Carrier Corp., Chicago. References: W. S. Bodinus, N. E. Bueter, A. L. Crump, T. M. Cunningham.

△Himelblau, Harry, Pres., Himelblau Assocs., Inc., Chicago. References: M. W. Bishop, J. H. Clarke, J. T. Coogan, J. J. Hayes.

Hultgren, P. B., Asst. Chief Engr., Illinois Engrg. Co., Chicago. References: M. W. Bishop, R. L. Gifford, J. J. Hayes, J. C. Matchett.

Husarik, E. J., Mech. Engr., E. R. Gritschke & Assocs., Chicago. References: E. R. Gritschke, L. P. Lang, J. W. Scharres, H. G. Swart.

Knutson, H. G., Vice Pres., Octagon Ventilator Co., Chicago. References: N. S. Booth, A. J. Charmoli, G. J. Karas, John Maras.

Melgaard, W. H., Treas., Frontier Htg. Co., Chicago. References: H. Hermansen*, A. I. Leapley*, R. C. Peterson*, A. I. Solan.

Moss, R. K., Engr., J. P. Bazzoni & Assocs., Chicago. References: J. P. Bazzoni, J. C. Scott, H. H. Van Epps, G. V. Zintel.

Streb, G. W., Sales Engr., Chicago Conditionaire Co., Chicago. References: J. T. Coogan, J. G. Heitman, W. L. Long, R. J. Thygerson, Jr.

Tapper, W. A., Sole Owner, Central Htg. Co., Des Plaines. References: R. Cooper, Jr.*, W. G. Pennington, Paul Ruble*, R. J. Stewart*.

Vyborny, C. A., Jr., E. R. Gritschke & Assocs., Chicago. References: H. G. Gragg, E. R. Gritschke, J. W. Scharres, H. G. Swart.

Indiana

△Grossman, F. A., Air Cond. Engr., Servel, Inc., Evansville. References: N. E. Berry, H. C. Pierce, J. M. Townsend, A. E. Vroome.

King, M. A., Engr., Ammerman, Davis & Stout, Inc., Indianapolis. References: F. C. Barton, T. R. Davis, S. H. Perham, G. B. Supple.

Rapp, W. J., Contract Mgr., The Philip Carey Mfg. Co., Indianapolis. References: R. B. Carter*, W. W. Grear, J. T. Hardin, C. L. Hoshaw.

Shank, J. L., Owner, John L. Shank Htg. Equipment, Indianapolis. References: R. G. James, Ferdinand Jehle, A. O. Roche, Jr., G. B. Supple.

Kansas

Lowensohn, R. S., Asst. Chief Engr., O. A. Sutton Corp., Wichita. References: E. C. Blood, B. W. Jewell, D. J. Mull, H. D. Speyer.

Louisiana

Dupuy, R. F., Design Engr., Ethyl Corp., Baton Rouge. References: C. E. Daniel*, C. V. Kardes*, G. S. Roberts*, C. S. Woodruff.

Maryland

Grimberg, J. C., Pres., John C. Grimberg Co., Hyattsville. References: W. C. Jones, F. A. Leser, F. M. Thuney, G. R. Walz.

Massachusetts

Reardon, J. A., Jr., Partner, Reardon & Turner, Boston. References: W. J. Ahearn, D. W. Blair, G. E. Fickett, M. I. Kishler.

Turner, F. J., Partner, Reardon & Turner, Boston. References: W. J. Ahearn, D. W. Blair, G. E. Fickett, R. G. Vanderweil.

Wilson, D. E., Pres.-Treas., Fitchburg Sheet Metal Works, Inc., Fitchburg. References: W. H. Dolan, J. M. Kane, R. T. Kern, J. M. Pettingell.

Michigan

McClellan, C. H., Engrg. Analyst, The American Blower Corp., Dearborn. References: C. J. Henstock, D. J. King, D. R. McClellan, A. E. Waite.

Tiefel, P. M., Sales Engr., D. T. Randall & Co., Detroit. References: W. G. Dolgner, R. H. Oberschulte, R. D. Randall, W. P. Ziemba.

Minnesota

Barr, H. D., Engr., Fuel Economy Engrg. Co., St. Paul. References: N. D. Adams, O. L. Lilja, H. A. Magy, Earl Nelson*.

Missouri

Byus, R. L., Engr., E. K. Campbell Co., Kansas City. References: E. K. Campbell, R. P. Campbell, E. E. Ralston, W. A. Reichow.

Davies, J. F., Mech. Engr., William L. Cassell, Kansas City. References: D. M. Allen, J. G. Barnes, Jr., F. K. Ladewig, E. E. Ralston.

Kilker, R. L., Engr., The Powers Regulator Co., Kansas City. References: P. A. Moreno, F. N. Schaad, R. M. Spencer, K. M. Stevens.

△Ladewig, F. K., District Mgr., The Trane Co., Kansas City. References: W. E. Howarth, R. B. Mason, Gustav Nottberg, W. A. Reichow.

△McIntosh, J. W., Branch Mgr., United States Radiator Corp., St. Louis. References: A. T. Bevil, R. W. Johnson, N. C. Ledbetter, A. W. Lenz.

Nebraska

Danielson, K. E., Mech. Engr., Corps of Engineers, Omaha. References: C. A. Carter, F. E. Hawley, F. P. Manchester, Jr., O. J. Smith.

Stober, M. F., Chief Mech. Engr., Leo A. Daly Co., Omaha. References: R. C. Detrich, D. C. Griffin, G. E. Merwin, L. J. Paulson.

Wright, D. E., Mech. Engr., Corps of Engineers, Omaha. References: C. A. Carter, F. E. Hawley, F. P. Manchester, Jr., O. J. Smith.

New Jersey

Bips, H. O., Engr., Hemminger Co., Newark. References: C. Graham*, E. Judd*, W. Tegan*, J. Weigang*.

Chudoba, C. V., Test Asst., Worthington Corp., Harrison. References: Frank Beck*, W. O. Osborne*, W. C. Smith*, E. H. Spillar*.

Cook, E. F., Engr., Air and Heat Co., Newark. References: A. H. Bermel, William Caddle, R. S. Taylor, Fred Wendel.

Kilgen, G. J., Pres., Glen Ridge Construction Co., Glen Ridge. References: F. H. Faust, L. G. Huggins, A. H. Moraweck, Jr., H. P. Morehouse.

Lynch, D. W., Mgr., Engrg., Heat Pump Dept., General Electric Co., Bloomfield. References: H. M. Brundage, F. H. Faust, W. L. Knaus*, J. Neuhoff*.

Parmelee, C. E., Engr., A. F. Hinrichsen, Inc., East Orange. References: E. T. Best, E. W. Gifford, C. F. Kayan, G. C. Norman.

Perelli, C. A., Mech. Engr., Wigton-Abbott Corp., Newark. References: E. C. Lang, G. C. Norman, J. A. Powell*, A. M. Truhan.

†Stengel, F. J., Secy., R. F. Stengel & Son, Hillside. References: C. M. Humphreys, L. B. Ray, W. F. Raymer, Jr., T. F. Rockwell.

New York

Blumenstein, Stanley, Engr., Infra Insulation Inc., New York. References: F. H. Faust, J. C. Fitz, L. G. Huggins, W. A. Swain.

Dreyfuss, J. F., Engr., The Trane Co., Syracuse. References: B. E. Judges, R. G. Lubinsky, A. C. Menke, M. R. Paulsen.

Gerard, Martin, Pres., Coldstream Air Conditioning Corp., New York. References: Martin Elkind*, A. P. Hess*, E. A. Kaplun, Arnold Lefkowitz*.

Greenberg, Alfred, Mech. Engr., Jaros, Baum & Bolles, New York. References: Kimon Demetrion*, A. C. Kuentz*, G. F. Rainer*, T. W. Schreiber.

Hubbell, J. E., Special Project Officer, U.S. Air Force, Eastern Air Procurement, New York. References: Milton Alperin, William Cotliar, E. F. Dawson*, D. B. Turkington*.

Klein, Edward, Service Mgr., H. Klein & Sons, Inc., Mineola. References: H. J.

Campbell, Jr., W. G. Kane, A. S. Miller*, J. L. Page.

Mitsch, L. J., Engr., Levi Case Co., Inc., Schenectady. References: G. G. Davis, W. L. Jacobs, Earl Landfear*, R. J. Tougher.

Pirillo, R. P., Engr., Air & Refrigeration Corp., New York. References: J. H. Burges, H. S. Dutcher, W. L. Fleisher, Sr., D. C. Lindsay.

Spear, J. S., Engr., Sarco Co., Inc., New York. References: Louis Barfus, R. E. Bolaffio, L. C. Medcalf, T. R. Stevens.

Storper, S. J., Engr., Infra Insulation Inc., New York. References: F. H. Faust, J. C. Fitz, L. G. Huggins, W. A. Swain.

Swain, W. A., Engr., Jenkins Bros., New York. References: H. H. Bond, O. O. Oaks, A. J. Offner, R. A. Wolff.

Warren, R. P., Mgr., Air Cleaning Div., Buffalo Forge Co., Buffalo. References: C. C. Cheyney, R. D. Madison, H. A. Mosher, W. N. Witheridge.

North Carolina

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Ohio

Bell, J. A., Jr., Htg. Engr., Radiant Co., Inc., Dayton. References: L. P. Brehm, Jr., J. M. Schweiger, D. E. Tullis, C. D. Weaver.

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Jones, W. V., Mgr., Heating Dept., Parker Woods, Plbg. & Htg., Columbus. References: J. W. Ford, J. A. Guy, W. A. Schoonover, R. A. Wilson.

Mitchell, N. O., Engr., Minneapolis-Honeywell Regulator Co., Dayton. References: L. P. Brehm, Jr., F. H. Doench, Jr., J. M. Schweiger, W. G. Wilkins.

△Neiheiser, W. F. D., Air Cond. Engr., The Feldman Bros. Co., Cleveland. References: L. F. Auerbach, D. B. Billington*, S. R. Guilbert, E. F. Morse.

Pillifant, Albert, Jr., Engr., Russell F. Faulks Co., Cleveland. References: J. M. Black, L. C. McClanahan, C. W. Pressler, E. J. Sable.

△Powers, L. G., Branch Mgr., Carrier Corp., Cincinnati. References: W. A. Bornemann, E. H. Dafter, H. E. Sproull, A. E. Stacey, Jr.

Reagan, R. F., Const. Supt., Avery Engrg. Co., Cleveland. References: Lester T. Avery, J. M. Black, C. W. Pressler, J. E. Wilhelm.

Oregon

Akin, Vernon, Designer, J. Donald Kroeker & Assoc. Portland. References: I. P. Byrne, R. H. Hendron, E. E. Kelly, J. D. Kroeker.

Stanley, A. E., Estimator, Vengelen & Vincent Co., Inc, Portland. References: D. L. Benz, G. C. Day, W. F. Kelly, Jr., W. C. Miller.

Timmer, C. W., Engr., Johnson Service Co., Portland. References: R. C. Chewning, B. W. Farnes, J. P. McDermott, R. L. Schroeder.

Pennsylvania

†Allen, W. A., Mgr., Pennsylvania Industrial Supplies Co., Pittsburgh. References: E. C. Hach, F. C. McIntosh, C. H. Schneider, B. B. Reilly.

Beres, J. G., Application Engr., John Harrison Co., Pittsburgh. References: E. C. Hach, N. W. Rainey, J. N. Riley, E. C. Smyers.

Bunten, W. H., Pres., All American Metal Products Co., Inc., Philadelphia. References: H. H. Erickson, I. Kramer*, W. L. Lynch, William Raffone*.

De Fazio, S. J., Mgr., Automatic Htg. & Appliance Co., Scranton. References: V. R. Bitzer, G. M. D. Lewis*, R. M. Marrazzo, Vincent Russinello.

†Sanbern, E. N., Estimating Engr., Industrial Insulation Inc., Pittsburgh. References: W. H. Bateman, Ferdinand Jehle, E. W. Meyer, H. E. Park.

Stickle, K. W., Repr., E. J. Deckman Co., Pittsburgh. References: J. W. Allison, G. M. Comstock, G. W. Cost, T. F. Rockwell.

Werden, R. G., District Mgr., York Corp., Philadelphia. References: R. H. Ackermann, F. H. Buzzard, John Everetts, Jr., J. P. Murdoch.

Texas

†Anderson, N. B., Mgr. and Owner, Water Heating Supply Co., Houston. References: Sid Bromberg*, Don Howeth*, Joe Maloney*, R. F. Taylor.

Goll, R. W., Allied Sheet Metal & Roofing Co., Houston. References: D. E. Dahlin, Jr., B. P. Fisher, C. L. Fleming, W. L. Lashley, Jr.

Lockridge, H. L., Supvsr., Allied Sheet Metal & Roofing Co., Houston. References: W. L. Barnes, B. P. Fisher, C. L. Fleming, W. L. Lashley, Jr.

△Lohrman, H. J., Jr., Chief Mech. Engr., Wyatt C. Hedrick, Architect-Engr., Dallas. References: C. O. Jensen, E. N. Pettit, Jr., C. F. Riehl, F. T. Saadeh.

†Mehl, O. H., Branch Mgr., Carrier Corp., Houston. References: J. H. Carnahan, R. G. Lyford, G. H. Meffert, R. J. Salinger.

△Pyeatt, B. P., Jr., Engr., Ray Claxton Air Conditioning, Dallas. References: Ray Claxton*, S. T. Lake, Jr., W. J. Oonk, J. D. Poythress.

△Rea, James L., Jr., Mgr. Calcasieu Lumber Co., Austin. References: F. B. Frazee, L. H. Hornor, Jr., D. E. Locher, W. E. Long.

Romero, C. A., Mech. Engr., Corps of Engineers, Galveston. References: C. D. Adams*, M. E. Linn, J. A. Poole, J. L. Powell.

Washington

△Towne, R. M., Mech. Engr., Richard M. Stern, Cons. Engr., Seattle. References: W. W. Cox, E. O. Eastwood, W. B. Pride, R. M. Stern.

Wisconsin

Barry, R. E., Gas Sales Engr., Wisconsin Power and Light Co., Madison. References: C. G. Extrom*, R. G. Koch, F. I. Nunlist, O. J. Ress.

Boyle, T. W., Owner, T. W. Boyle Co., Milwaukee. References: C. C. Depner, J. E. Illingworth, J. S. Jung, J. A. Lofte.

Faust, E. W., Jr., Htg. Engr., William Faust & Co., Milwaukee. References: E. Farber*, N. E. Hill, D. W. Nelson, S. G. Swisher, Jr.

Melcher, C. E., Mfrs. Repr., C. E. Melcher Co., Milwaukee. References: C. C. Depner, J. E. Illingworth, J. A. Lofte, R. D. Rodwell.

Canada

Barker, R. O., Designer-Owner, Weston Refractories Co., Toronto. References: H. A. Duerr*, J. D. Gretton, Victor Herbert, J. B. Parkin*.

Burnside, J. A., Prof. Engr., Grinnell Co. of Canada Ltd., Toronto. References: A. E. Clark, J. D. Coates, W. M. Flanagan, K. E. Gould.

Dennis, R. L., Salesman, Standard Sanitary & Dominion Radiator Ltd., Toronto. References: Thomas Ferguson, William Philip, George Reed*, R. Taylor*.

Norling, A. M., Mgr., American Air Filter of Canada Ltd., Toronto. References: W. G. Hole, Arthur Nearingburg, H. R. Roth, Andrew Tait.

Poliansky, Nicolas, Mech. Engr., McDougall & Friedman, Montreal. References: Robert Clapperton, R. R. Duquette, F. J. Friedman, E. J. Gilbert.

Thomson, A. T., Vice Pres. & Gen. Mgr., Fueloil & Equipment Ltd., Toronto. References: R. F. Chisholm*, O. H. Ferguson*, N. W. Kingsland, N. S. Robertson*.

Turner, W. J. M., Testing Engr., Canadian Standards Assn., Toronto. References: J. D. Barnes*, V. B. Coxworth*, D. M. Dymond, A. W. Rae.

Holland

Terneden, J. A., Tech. Mgr., N. V. Ned. Aircond. Mij Gebr. van Swaay, The Hague. References: Philip Goldmann*, Walther Pichel*, Americo Silvera, J. M. van Swaay.

van Reeden, Gerrit, Mgr., N. V. Ned. Aircond. Mij Gebr. van Swaay, The Hague. References: Walther Pichel*, F. Prakke*, E. Thurmann-Andersen*, J. M. van Swaay.

Switzerland

Koller, Emil, Bacher AG Reinach/Basle, Basle. References: A. Ammann*, B. Schmiedt*, H. J. Stehle*, P. Zaninetta*.

Venezuela

Nielsen, C. P., Consultant and Repr., Trane Co., Caracas. References: J. C.

Carlisle*, Frank Hawk*, P. C. Hutchins, F. X. Morgan.

Students

OKLAHOMA A & M COLLEGE, Stillwater, Okla. CERTIFIED BY: R. R. Irwin*.

LUNDGAARD, BERTEL MYERS, M. J. SCHMIDT, R. P. SIMON, F. V., JR.

PURDUE UNIVERSITY, Lafayette, Ind. CERTIFIED BY: F. B. Morse.

DEAN, R. B. JENCO, G. R. GREEN, K. D.

UNIVERSITY OF MINNESOTA, Minneapolis, Minn. CERTIFIED BY: A. B. Algren.

NELSON, L. W.

UNIVERSITY OF TORONTO, Toronto, Ont., Canada. CERTIFIED BY: F. G. Ewens.

ACTON, M. H. PIERCY, R. F.
DI NOVO, P. C. TANTON, G. F.
KRISTUFEK, EDUARD WEIR, J. R.

OBITUARIES

CECIL I. CADY
New York, N.Y.

Cecil I. Cady, newly elected member of the Society, died in Tarrytown Hospital on January 31 at the age of 64.

Mr. Cady was born on June 21, 1888, in Newcastle, N.Y. He attended Stevens Institute of Technology, graduating in 1910 with a B.S. in Mechanical Engineering. At the time of his death Mr. Cady was chief electrical engineer with the architectural-engineering firm of Voorhees, Walker, Foley and Smith, with whom he became associated in 1920. Among the electrical installations made under Mr. Cady's supervision were those of the Bell Telephone Laboratories in Murray Hill, N.J., the Western Union Building, the New York Telephone Building, and the Irving Trust Company Building, all in New York; also the Henry Ford Hospital and Clinic in Detroit. Mr. Cady had been with the Chevrolet Motor Company and the Bridgeport Brass Co. earlier in his career.

Mr. Cady was a member of the *American Society of Mechanical Engineers*, the *National Society of Professional Engineers*, and the *American Institute of Electrical Engineers*. He was a registered professional engineer in the states of New York and New Jersey.

The Society's Officers and Council extend their deep sympathy to Mr. Cady's widow, Mrs. Paula L. Cady.

FRANK C. CULVER
Seattle, Wash.

Frank C. Culver, a faithful member of the Society's Pacific Northwest Chapter, died on February 5 after an extended illness. Mr. Culver was a manufacturer's representative for such firms as the Day and Night Manufacturing Co., Bryant Heater Co. and the Gasair Corp.

Born on August 8, 1885, in Pasadena, Calif., Mr. Culver attended Pasadena High School and Pomona College, graduating in 1908 with a B.S. degree in Science. From 1909 to 1939 he was engaged in a variety of occupations including that of estimator, contractor, sales of gas and electrical appliances, and building of gas distributing plants. In 1939 he joined L. C. Roney, Inc., as a sales engineer with whom he remained until 1942 when he became a manufacturer's representative.

Mr. Culver joined the Society in 1945, and he was also a member of the *Liquefied Petroleum Gas Association* and the *Pacific Coast Gas Association*.

Surviving Mr. Culver are his wife, a son, daughter and seven grandchildren, to whom the Officers and Council of the Society offer their profound sympathy.

GEORGE B. RICHMOND
Memphis, Tenn.

The Society recently was notified by the Hunter Fan and Ventilating Co., Memphis, of the passing on January 22, of its chief ventilating engineer, George B. Richmond.

Born on June 13, 1891, in Elburn, Ill., Mr. Richmond attended Elburn High School and the University of Illinois. Mr. Richmond served as secretary of the *Heating and Piping Contractor's Association* from 1925-31, at which time he joined the Memphis Power and Light Co. He was employed with the Memphis Power and Light Co. from 1932-38 as supervisor of the Gas House Heating Department. In 1938 Mr. Richmond joined the Hunter Fan and Ventilating Co., with whom he was associated at the time of his death.

The Officers and Council of the Society extend their deep sympathy to his widow and his son, George, for their loss.

EDWARD H. SEELERT
Minneapolis, Minn.

Word has been received by the Society of the passing of Edward H. Seelert, Society member since 1935, on January 1. Mr. Seelert was secretary-treasurer of McQuay, Inc., Minneapolis.

Mr. Seelert was born on December 29, 1892 in Germany and attended grade and high school. From 1910 to 1912 Mr. Seelert was a machinist apprentice with Mosler Safe Works and from 1912-15 he served as a machinist with the Big Four Tractor Co. During the years between 1915 and 1932 Mr. Seelert served, successively, as a toolmaker with the Minneapolis Moline Implement Co., as a machine foreman with the Midway Engineering Works, and as factory superintendent with the Hayes Shock Absorber Co. and the McQuay Radiator Corp. He joined McQuay, Inc. in 1932 as a factory manager.

The Officers and Council of ASHVE express their sincere sympathy to the members of Mr. Seelert's family.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

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Proceedings of the National District Heating Association, Vol. XLI, 1950, Pittsburgh, Pa. *National District Heating Association*, 1953. Gift of the *Association*.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(52 Chapters—1 Special Branch—9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, Herman Cumnock, 401 W. Capitol Ave. SECRETARY, W. J. Franklin, 1516 S. Pierce St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. G. Croley, 400 Batavia St., East Point, Ga. SECRETARY, T. A. Barrow, 157 Simpson St., N.W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 3935 Stokes Dr. (29).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Minaker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. E. Krell, 116 Fernwood Ave. (5). SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 330-34 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 889 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 2701 Roosevelt Ave., (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 4119 Northwest Dr. (10). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 7035 Grand Ave. (14). SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 608 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, P.O. Box 7077, Riverton Hgts, Br. (88).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, N. H. Brickham, 2715 S. Humboldt St. (10). SECRETARY, A. S. Widdowfield, 1925 Blake St. (2).

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. PRESIDENT, L. A. O'Meara, 1400 Tenth St. SECRETARY, J. E. Marshall, 441 Pico Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, W. S. Evans, 614 Johnson Bldg. SECRETARY, J. S. Malahy, Jr., 1839 Line Ave.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, H. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH: 1944.** Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. R. Walz, 5214 25th Pl. N., Arlington (7) Va. SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N.W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, J. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 260 Richmond Ave. (22).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lotte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, E. M. Todd, Jr., 139 N. Duncan. SECRETARY, R. P. Schmidt, 310 S. Knoblock.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

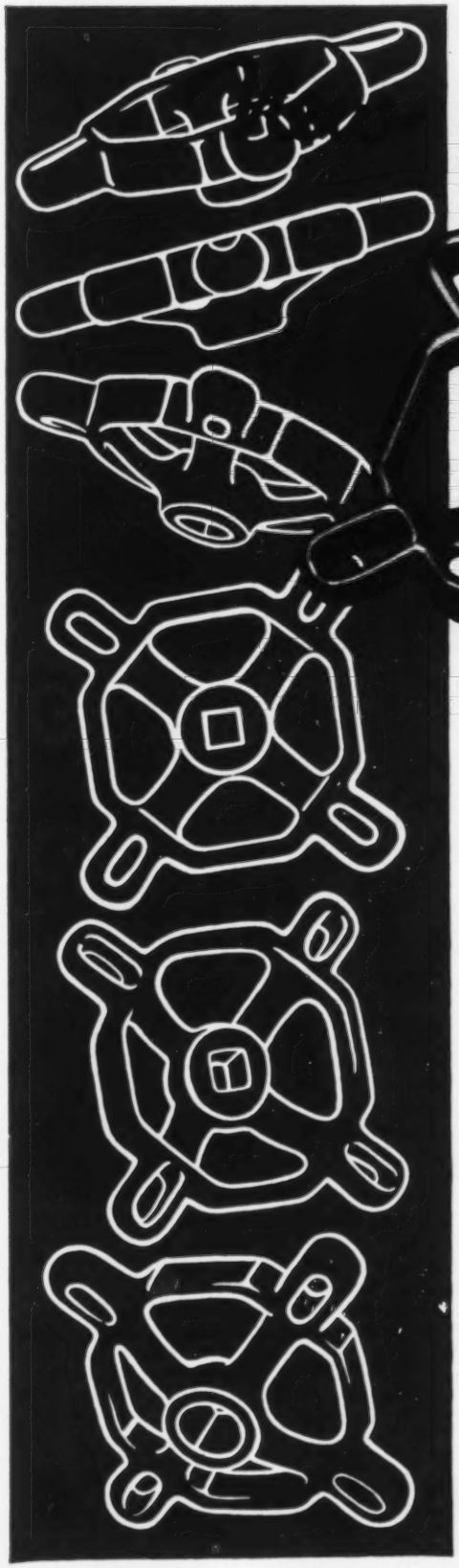
● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.



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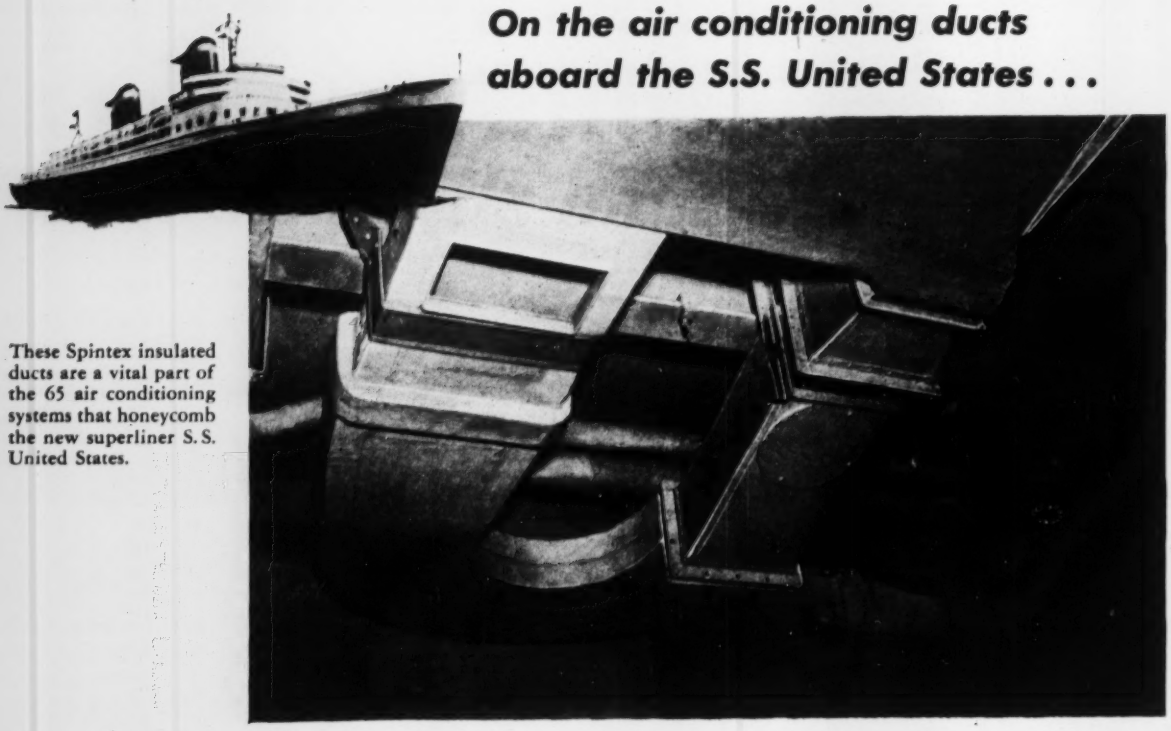
L-7814

On the air conditioning ducts aboard the S.S. United States . . .



These Spintex insulated ducts are a vital part of the 65 air conditioning systems that honeycomb the new superliner S. S. United States.

NEW J-M *Spintex* INSULATION CONSERVES FUEL AND POWER

MILES OF DUCTS . . . a vital part of the 65 air conditioning systems that honeycomb the S. S. United States . . . are insulated with Johns-Manville Spintex. This insulation was selected because it makes possible maximum passenger comfort at minimum operating cost.

Low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth . . . make Spintex the most effective insulation for guarding against heat transfer and moisture accumulation.

Spintex in flexible and semi-rigid types, plus rigid Rock Cork* and Zerolite*, form a team of Johns-Manville insulations for air conditioning ducts that meet every industrial requirement. Basically mineral products, each insulation has its particular characteristics that make it specially suitable for a specific air conditioning service. All three have the low heat transfer properties needed for high insulating efficiency. Properly installed, these insulations for air conditioning ducts will perform their function effectively for the entire life of the equipment on which they are applied.

Since proper application is so essential to the peak performance of any insulation, Johns-Manville offers industry the services of experienced installation contractors who have made a career of solving complex insulation problems.

J-M Insulation Engineers and J-M Insulation Contractors are conveniently located. They stand ready to combine their talents and give you an insulation job that will pay off your initial investment with maximum fuel savings.

* * *

Why not let us send you a free copy of Brochure IN-135A which gives all the facts about Johns-Manville Insulations for Air Conditioning Ducts? Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Applying Johns-Manville Spintex insulation on one of the ducts aboard the S. S. United States during construction at the Newport News Shipbuilding and Dry Dock Company. Johns-Manville Insulation Contractors throughout the country know Spintex and other J-M insulations as *quality* products, and take pride in applying them properly for peak performance.

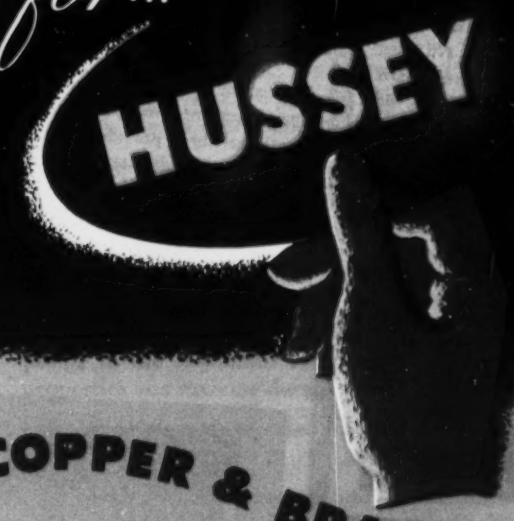
Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

Lifetime Service

calls for...

HUSSEY



COPPER & BRASS

Jobs like yours, where corrosion is accelerated and efficiency is essential both in installation and actual service, call for the finest materials you can use. Hussey Copper offers you peak corrosion resistance, excellent efficiency in thermal conductance and emissivity *plus* uniformity and ease of fabrication that's hard to beat. If you have not been using these advantages of genuine Hussey Copper, figure it into your *next* job. Order Hussey Copper direct from the mill or from your nearest Hussey Copper warehouse.

Since 1848

C. H. HUSSEY & COMPANY

(Divison of Copper Range Co.)

***Rolling Mills and General Offices:* Pittsburgh 19, Pa.**

7 Convenient Warehouses to serve you

PITTSBURGH (19), 2820 Second Avenue
CLEVELAND (14), 2519 St. Clair Avenue
NEW YORK (13), 140 Sixth Avenue
CHICAGO (12), 2900 N. Western Avenue
PHILADELPHIA (28), 1605 Fairmount Ave.
CINCINNATI (2), 434 Commercial Square
ST. LOUIS (3), 1030 Delmar Boulevard

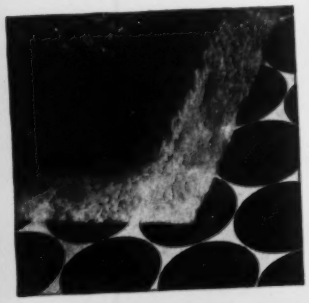
it pays to sell the Profit Line!

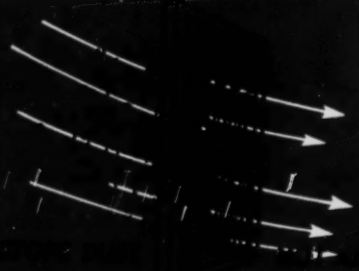
3 PRODUCTS—30-50% MORE PROFIT

Glasfloss is a *complete line* of glass fibre disposable Air Filters—not a *single* type. With the Glasfloss Line, you sell the right filter for every clean air filtering problem, and make 30% to 50% more profit. There are 3 products—3 profits—all backed by a promotional campaign that hits hard to help you sell.

1 *Glasfloss*
I-S TYPE

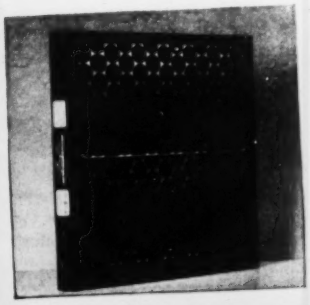
For peak air filtering efficiency, the GLASFLOSS I-S Air Filter Unit is the answer. Here a strainer mat has been added to the famous long, glass fibres that make up the standard GLASFLOSS Air Filter pad. The combination brings air filtering efficiency to as high as 95%. No other air filter on the market can compare. Figured on Peak Efficiency you win with Glasfloss.





2 *Glasfloss*
STANDARD TYPE

This is the conventional type—the filter most in demand. The long, fine glass fibres provide a greater surface area to catch and hold more dust with less air resistance. The Glasfloss STANDARD Filter is primarily intended for home heating equipment and normal industrial installations. Available in all standard sizes. Competitively priced to beat the field.



3 *Glasfloss*
ROLL-PAK TYPE

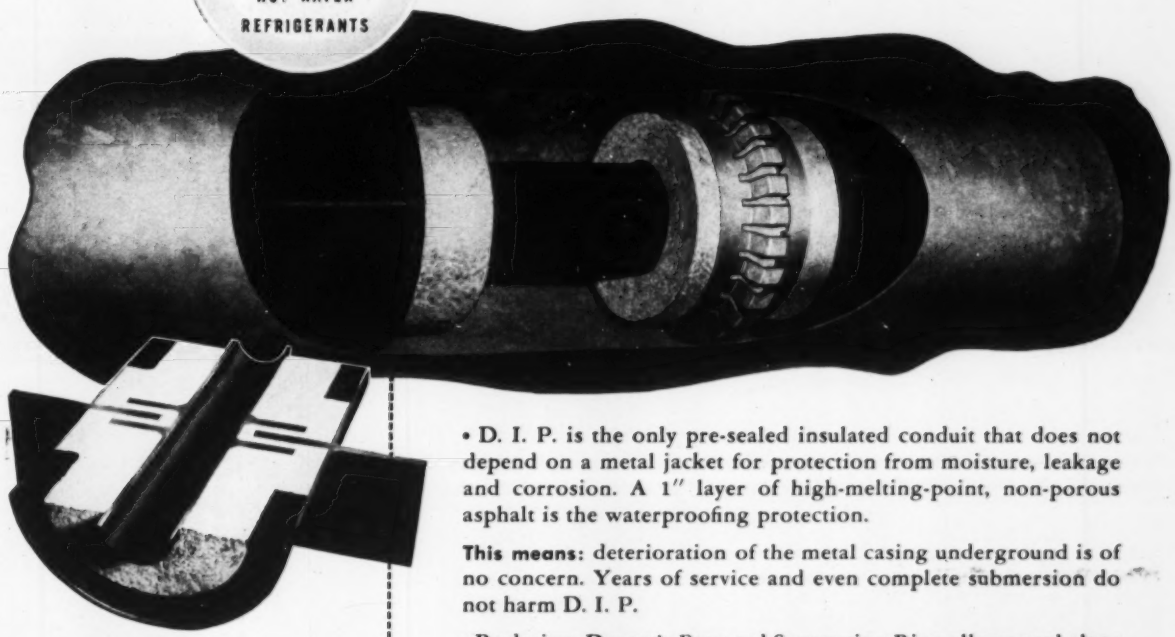
Here is a product carefully planned for bulk users. Cut your own filter pads—fit them into your own frames and save, with every change, as much as 30% of your normal air filter costs. Available in rolls, 40" wide and 10' long and 1" and 2" thickness. Application is easy. Just roll it out, cut to size and put into position. The fluffy, fine fibres are easy on the hands. For Economy in bulk usage it's Glasfloss all the way.

Glasfloss 155 EAST 44TH STREET, NEW YORK 17, N. Y.

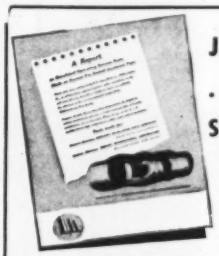
D.I.P.®

FIRST IN THE FIELD OF PRE-SEALED INSULATED PIPING FOR STEAM HOT WATER REFRIGERANTS

Only DURANT Pre-sealed Insulated Pipe gives you these features:



Durant Patented Insulated Anchor



JUST OFF PRESS ... A Report on Simulated Operating Service Tests Made on D.I.P.

This 6 page bulletin contains a detailed report on methods, temperature recordings and results of recent tests made by an independent engineering firm to determine (1) temperatures developed in and near D.I.P. conduit buried 48" underground, and (2) effects, if any, on D.I.P. due to high temperature and water-soaked insulation.

May we have your address so we can mail you a copy?

Representatives in Principal Cities

PRE SEALED®

- D. I. P. is the only pre-sealed insulated conduit that does not depend on a metal jacket for protection from moisture, leakage and corrosion. A 1" layer of high-melting-point, non-porous asphalt is the waterproofing protection.

This means: deterioration of the metal casing underground is of no concern. Years of service and even complete submersion do not harm D. I. P.

- By design, Durant's Patented Supporting Ring allows asphalt to flow through openings during fabrication to *encase* the ring.

This means: water or moisture cannot pass through support points to the insulation or pipe. It means efficient insulating properties and extreme durability.

- Durant's Patented Insulated Anchor eliminates contact between anchor plate and pipe.

This means: reduced heat loss and elimination of corrosive electrolytic action at anchor points.

Many other advantages come with D. I. P.—such as low cost installation, for the Durant field joint can be made swiftly and easily. D. I. P. does not require external casing-welding: nor does it require concrete tunnels, slabs, rollers, supports, drains or additional protection for superimposed loads—such as under roadways or railroad tracks. Steam pressures to 1000 psi.

Durant's engineering staff and representatives are at your service. Write us today for Catalog 4-A.

Western Division: **DURANT INSULATED PIPE COMPANY**
WARREN WAY AND BAY ROAD, PALO ALTO, CALIFORNIA

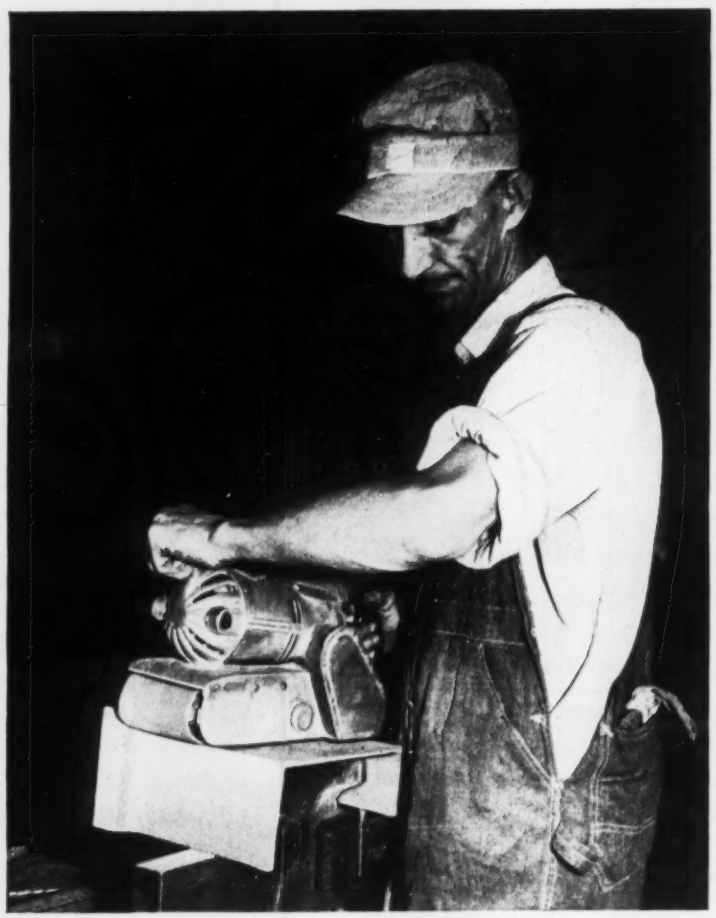
Eastern Division: **DURANT INTERNATIONAL CORPORATION**
WILLIAMSTOWN, NEW JERSEY

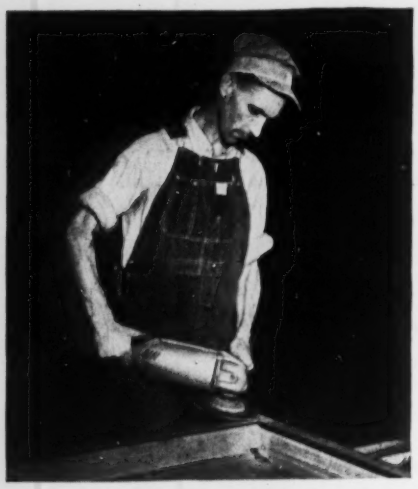
"SKIL Sanders?... best performance, least maintenance, most durable of all we've used!"

says **Roy Hollcroft,**
W. & W. STEEL COMPANY,
Oklahoma City, Oklahoma

"We've refinished metal with this model 323 SKIL Belt Sander for more than three years. It has the reserve power and right weight you've got to have for this work. It's taken plenty of punishment without giving any trouble. Beyond question SKIL makes the most *durable* belt sanders.

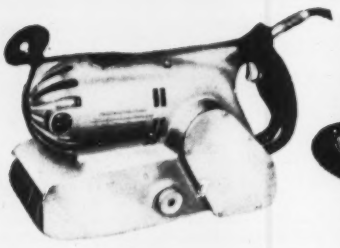
"We've had our SKIL Disc Sander in constant use for *five* years," Hollcroft continues, "and it's given us far better performance than any other make. In all this time, we haven't laid out a penny for repairs."



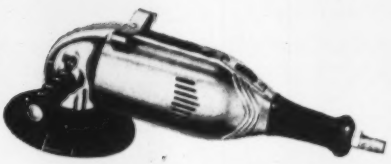


SKIL
PORTABLE TOOLS

Made only by SKIL Corporation
formerly SKILSAW, Inc.
5033 Elston Avenue, Chicago 30, Illinois
SKIL Factory Branches in 34 Principal Cities
In Canada: Skiltools, Ltd., 3601 Dundas Street West, Toronto 9, Ontario



SKIL Belt Sander—Model 323—Heavy duty for all sanding. Extremely powerful and sturdy for constant use. Belt width: 4½". No-load speed: 1300 r.p.m. Overall length: 15¾". Net weight: 23 lbs.



SKIL 7" Disc Sander—Model 11—Heavy duty. Ideal for removing weld marks on sheet metal; for auto body, truck, and tank repair work; for cleaning concrete forms. Also suitable for many wire brushing and grinding operations. Disc diameter: 7". No-load speed: 4200 r.p.m. Overall length: 16¾". Net weight: 11¼ lbs.

See your distributor for complete information or call your nearest SKIL factory branch

Putting Air to work for Sharp & Dohme: Germ-free air is essential. Just "fresh air" won't do in the world's largest plasma plant.

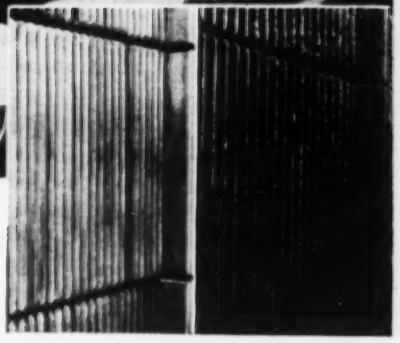
6000 MILES AWAY

PURE AIR FIGHTS BATTLE SHOCK

A wounded soldier's life depends on an early transfusion. But whole blood is perishable, and liquid plasma needs special storage. So dried plasma is used because it keeps its life-giving qualities for five years. That's why Sharp & Dohme's blood processing is so important—it accounts for over one third of today's output.

This operation is so delicate that just "fresh air" would contaminate precious plasma. To keep air at its highest purity, Sharp & Dohme uses Westinghouse PRECIPITRON®, the electronic air cleaner. Five PRECIPITRON units work 'round the clock to remove dirt and germs.

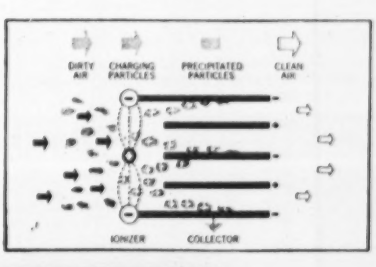
You can *put air to work*, too. Westinghouse has the equipment to handle it. For data on air cleaning, air handling or air conditioning products, ask for Catalog 600. Call your local Westinghouse-Sturtevant office. It's listed in the Yellow Pages. Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



CLEAN PLATES DIRTY PLATES

Here's How PRECIPITRON Works—All dirt particles in the air stream are charged and attracted to collector plates of the opposite polarity. The above photos show how much dirt is collected in 2½ weeks of cleaning "fresh air".

The PRECIPITRON is the most efficient air cleaner available commercially for removing impurities from normal air.



WESTINGHOUSE AIR HANDLING

The Armed Forces need blood. *Give a pint today!*

YOU CAN BE SURE...IF IT'S Westinghouse

J-60291

"MILLIONS of FEET of READING COPPER TUBING

Used Because of Long, Trouble-Free Service ... Time and Labor-Saving Installation"

Says

C. WALLACE PLUMBING CO.,

One of the Southwest's Oldest and Largest Mechanical Contractors!

Sam P. WALLACE
President

Frank E. WALLACE
Vice-Pres. & Treasurer

Carl Preston WALLACE
Secretary

Founded in 1902 by Carl Wallace, now the retired dean of the plumbing industry in Texas, the C. Wallace Plumbing Co. of Dallas, Houston, and Tulsa has grown in the past 50 years to be recognized as one of America's leading plumbing, heating and air conditioning contractors. Like many other outstanding contracting firms, the C. Wallace Plumbing Co. has chosen Reading Copper Tubing for many of their largest installations.

Chief among the reasons for this widespread contractor preference for Reading Copper Tubing are its uniform wall thickness, precision quality, ease of bending and resulting reduction in number of fittings required. You can profit by the experience of these contractors and enjoy these benefits by remembering to *specify Reading Copper Tubing when you order from your plumbing and heating supply wholesaler.*

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading 85% Grade A Red Brass Pipe

OFFICES AND EASTERN DISTRIBUTION DEPOT:
36-12 47th Ave., Long Island City, N. Y. • STillwell 6-9200
WORKS: READING, PA.

READING COPPER BRASS TUBING

DISTRIBUTION DEPOTS: Reading, Pa. • Long Island City, N. Y. • Houston, Texas, 1121 Rothwell St. Chicago, Ill., 724 W. 50th St. • Atlanta, Ga., 690 Murphy Ave. S.W. Unit 5, Bldg. B

7,000 fasteners set in concrete in 3,500 minutes

Saved $15,000 on 50,000 fastenings into steel

Fastener cost reduced from $2.53 to 24 cents

Cut fastening time from 9 minutes to 58 seconds

Lowered fastening cost 87%; reduced time 90%

Split-second fastening into steel or concrete with super-speed *Ramset Jobmaster*

FASTENING SYSTEM

Just as thousands of users have been saving for six years, you can slash cost and time of fastening into steel or concrete with RAMSET SYSTEM, pioneer in powder-actuated fastening.

Let us prove, on your own work, how the ten big features of the new RAMSET JOBMASTER add up to new speed, new economy, new ease, new utility. See the lightning-fast action—one-hand operation—accuracy of positioning—straight, firm penetration which only the JOBMASTER gives you.

Ask your dealer to do a sample job for you, and prove the dollars-and-cents value of doing every fastening job with RAMSET.

Always use Tru-Set Fasteners

Exclusive Red-Tip Pilot guides them straight to the work, with highest efficiency in performance. Four types in 56 sizes for split-second fastening into steel or concrete.

*Names of these RAMSET users and others in your locality available on request.

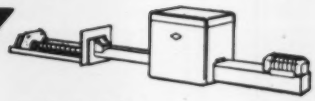
Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO

it pays to please your customers with rugged, reliable

WILL-BURT Stokers



domestic bin feed stoker

WILL-BURT BIN FEED STOKER

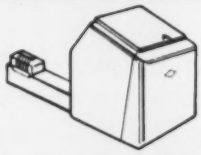
Capacities cover both domestic and commercial requirements.

commercial bin feed stoker

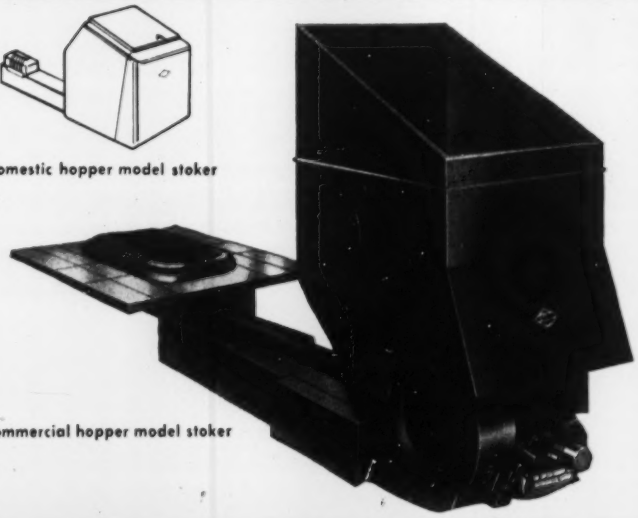
Selling stokers is more than just a good stock turnover . . . it's selling reliability and satisfaction, too. Satisfied customers actually become good-will salesmen—paving the way for your future profits. This Will-Burt bin feed stoker is designed for commercial and domestic installations wherever bituminous coal is burned. And look at the features! Exclusive automatic air control . . . patented protective shear pin . . . precision machined power unit. A patented flange and set screw locking device prevents the coal screw from disengaging from the drive shaft. Auxiliary air supply prevents back smoking. Sell satisfaction—sell Will-Burt.

WILL-BURT HOPPER MODEL STOKER

This Will-Burt Hopper Model Stoker also has capacities to cover your domestic and commercial needs. Equipped with the exclusive automatic air control for delivering correct quantities of air under constantly changing fire bed conditions. If an overload occurs—a protective pin shears, and an automatic switch stops the motor and fan. Strong, cast iron hopper base; heavy gauge rust-resisting steel hopper. Yes, Will-Burt is your key to increased stoker sales. Why not drop us a card or letter today . . . we'll be glad to give you more information concerning Will-Burt products and dealer arrangements.



domestic hopper model stoker



commercial hopper model stoker

THE WILL-BURT COMPANY

BOX 902 ORRVILLE, OHIO

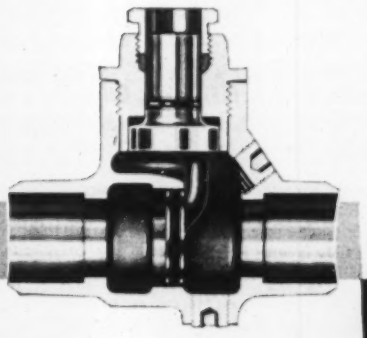
STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

O-B EQUATEMP®

. . . one valve for the complete balancing job

Check These Features

- Easy Regulation
- Complete Shutoff Possible
- Top and Bottom Drain Plugs
- Thermometer Well
- Simple Disassembly
- Well Installation Possible
- Double Protection Against Stem Leakage



The Equatemp balancing valve controls water flow in heating or cooling systems *and* acts as a positive, leaktight shut-off. Since it both balances and shuts off, Equatemp does a job that formerly required two or more valves and fittings.

The shutoff feature is a definite convenience and time-saver for venting or bleeding, draining, or repairing lines. It saves the trouble of shutting off the entire system.

The savings and convenience continue through the life of the valve. Two drain plugs permit venting or draining in any position -- upright or inverted. An easy-to-use Allen-type wrench is furnished for regulating.

Equatemp features rubber "O" rings on both the butterfly type disc and the stem. Conventional packing under nut at top provides *additional* protection against stem leakage.

Equatemps can be used on lines carrying water up to 212 degrees F., and up to 100 pounds gage pressure. For additional information, call your local O-B distributor or write to Ohio Brass, Mansfield, Ohio.

Ohio Brass

MANSFIELD (B) OHIO, U.S.A.

4375-V

TYPES AND SIZES

The No. 37 Solder-type Equatemp for tubing installations can be furnished in $^3/_8$, $^1/_2$ and $^3/_4$-inch sizes. The No. 38 Equatemp, with threaded pipe ends, is available in $^1/_2$, $^3/_4$, 1, $1^1/_4$ and $1^1/_2$-inch sizes.

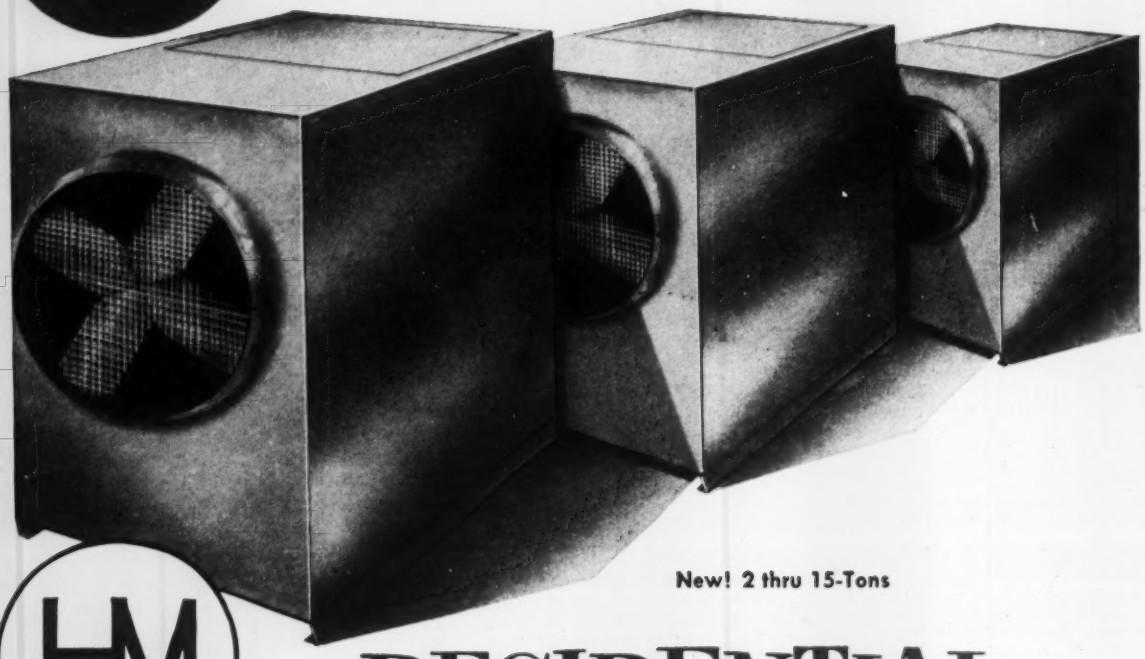
TYPICAL APPLICATIONS IN HEATING AND AIR CONDITIONING

Floor	Baseboard	Convector
Ceiling	Panel	Unit Air Conditioners
	Unit Heaters	

ANOTHER HALSTEAD & MITCHELL FIRST

20-Year Guarantee!

ON THE WETTED DECK SURFACE



New! 2 thru 15-Tons

HM

RESIDENTIAL COOLING TOWERS

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

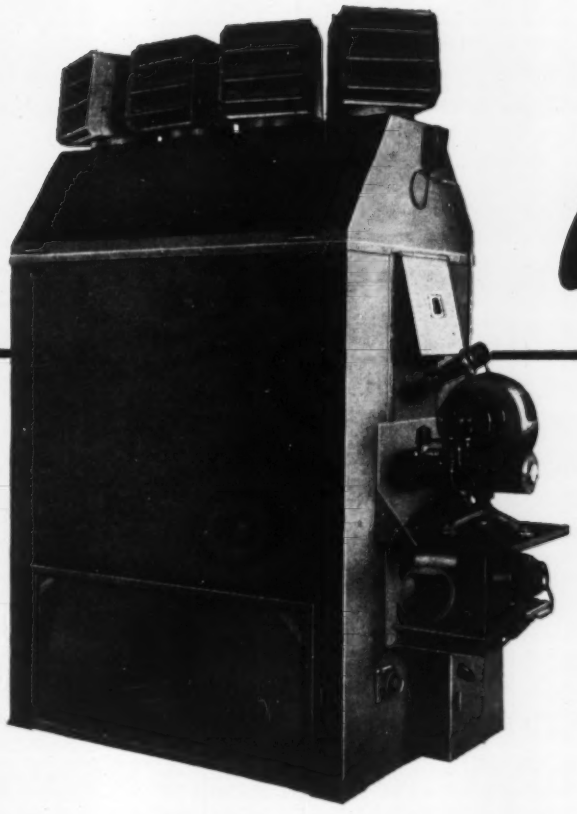
Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

HM Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.



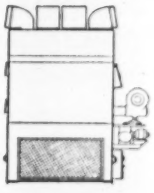
FOR *Long Life*

OLSON is a rugged heater that is built to provide maximum efficiency, day after day, year after year without interruption.

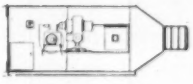
Take the heat transfer surface for example, the heart of any heater, certainly the vital part that determines the life of all heaters. Long Life depends on the amount of heat transfer surface.

OLSON through the use of standard 10 gauge, 4" O.D. boiler tubes, provides even more heat transfer surface than the highest recommendation of accepted heating authorities.

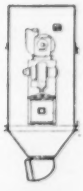
There is an OLSON heater to meet any heating requirement for space heating and special adaptions.



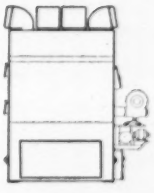
FLOOR MODEL



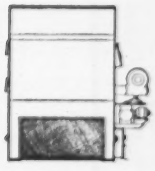
HORIZONTAL MODEL



INVERTED MODEL



RETURN AIR DUCT



DUCT TOP

ARTHUR A. OLSON & COMPANY

BROAD ST. CANFIELD, OHIO

Mail this coupon for further information about sizes and ranges, detailed operation.

Representatives in principal cities.

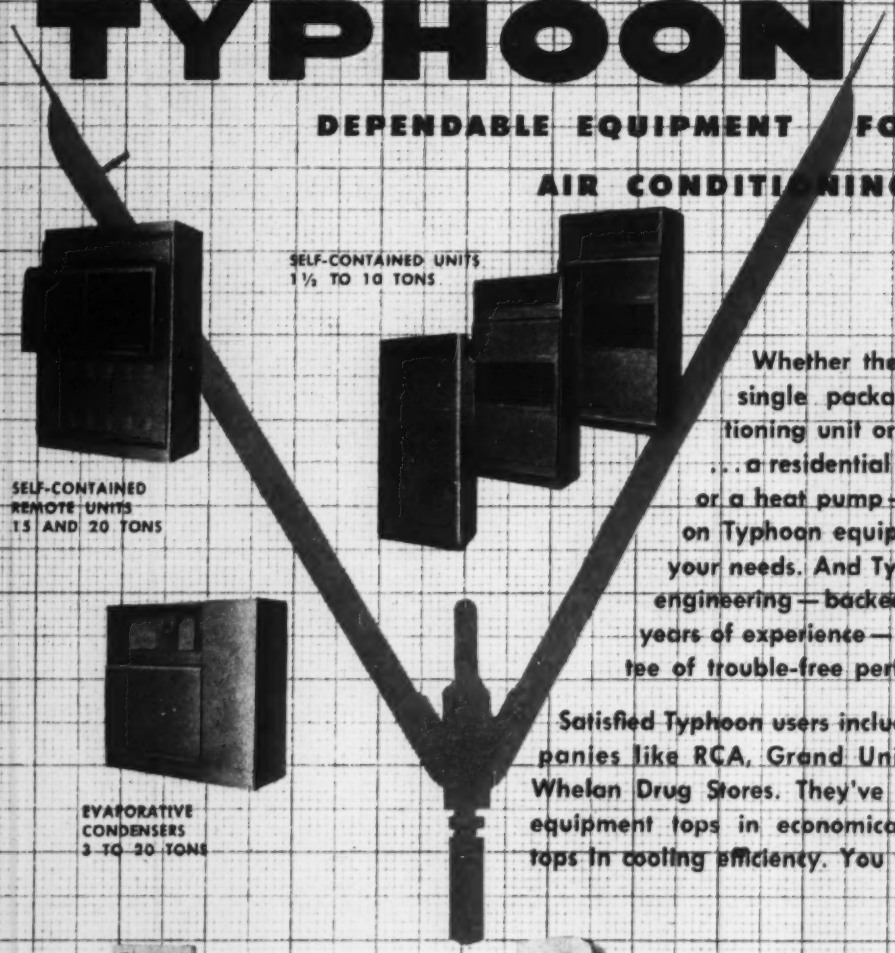
ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Please send me Olson Direct Fired Heater Catalog.

Name.....
Firm.....
Address.....
City.....State.....

Quality-Engineered by

TYPHOON

DEPENDABLE EQUIPMENT FOR YOUR AIR CONDITIONING NEEDS



SELF-CONTAINED UNITS
1½ TO 10 TONS

SELF-CONTAINED
REMOTE UNITS
15 AND 20 TONS

EVAPORATIVE
CONDENSERS
3 TO 20 TONS

RESIDENTIAL SUMMER-WINTER UNITS
2, 3, 5 TONS

PROP-R-TEMP
HEAT PUMPS
2 TO 20 TONS

Whether the job calls for a single packaged air conditioning unit or a central plant . . . a residential year-round unit or a heat pump — you can count on Typhoon equipment to supply your needs. And Typhoon's quality engineering — backed by over 40 years of experience — is your guarantee of trouble-free performance.

Satisfied Typhoon users include famous companies like RCA, Grand Union Stores and Whelan Drug Stores. They've found Typhoon equipment tops in economical operation . . . tops in cooling efficiency. You will, too.

Also . . .
Heating and Cooling Coils
Air Handling Units
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Multi-Package Systems
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Write for Detailed Information

TYPHOON AIR CONDITIONING CO., INC.

794 Union Street, Brooklyn 15, N. Y.

Specialists in Air Conditioning Since 1909

Easy to Order! . . .

. . . Quick and Easy to Install!

Grinnell Welding Fittings

Any qualified welder can make welds quickly and easily with Grinnell welding fittings. These fittings are made by a hydraulic forging process that assures uniform wall thickness at all points and true circularity throughout. Of seamless, one-piece construction, they can be cut at any angle to match up with standard weight, extra strong and heavier wall pipe in I.D. or O.D. sizes. Pressure-temperature ratings are equal to or greater than those of seamless steel pipe. Grinnell welding fittings are process stress-relieved.

Full data on the complete line of Grinnell seamless carbon steel welding fittings and forged steel flanges is contained in the Grinnell Welding Fittings catalog. Send for a copy.

GRINNELL
WHENEVER PIPING IS INVOLVED

RANGE OF TYPES AND SIZES

Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge: Nominal Pipe Size	Light Gauge: Iron Pipe Size
ELBOWS 90° Long Radius	½"-30"	½"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
90° Long Tangent	1½"-12"	1½"-12"	.....	.....	.....	.....
90° Reducing	2"x¾" to 6"x5"		.....	.....	.....	.....
90° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
45° Long Radius	½"-30"	¾"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
RETURNS 180° Long Radius	½"-30"	½"-30"	1"-12"	2"-8"	4"-24"	¾"-12"
180° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
180° Ex. Long Radius	1"-2½"	1"-2½"	.....	.....	.....	.....
TEES — Straight	½"-24"	½"-24"	½"-12"	½"-8"	.....	.....
Reducing Outlet	½"-24"	½"-24"	¾"-12"	¾"-8"	.....	.....
REDUCERS Concentric & Eccentric	¾"-24"	¾"-24"	¾"-12"	¾"-8"	.....	.....
CAPS	¾"-24"	¾"-24"	1"-12"	1"-8"	.....	.....
STUB ENDS — Lap Joint	½"-24"	½"-24"				
SADDLES	2"-24"					
LATERALS — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
CROSSES — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
BACKING RINGS	2"-24"	2"-24"				

Also available in certain sizes are: 90° long and short radius elbows, 45° long radius elbows and 180° long and short radius returns in Schedules 30, 40, 60 and 80.

Grinnell welding fittings and flanges conform to applicable ASA and ASTM Standards.

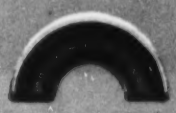
GRINNELL WELDING FITTINGS ARE QUALITY-CONTROLLED FOR DEPENDABILITY

TRUE CIRCULAR SECTION

True circular section at all points makes a Grinnell fitting easy to align and weld . . . there is no distortion or no flattening to affect flow adversely.

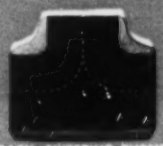
FULL EFFECTIVE RADIUS

The loss of pressure through Grinnell welding elbows is held down to an absolute minimum . . . because of the full and the effective sweep of the radius.



SMOOTH, CLEAN INSIDE SURFACE

Grinnell fittings have uniformly smooth inner walls . . . no waves or ridges to cause turbulence or accelerate erosion or corrosion. No pockets to trap solids.



EASY, SWEEPING TURNS

In Grinnell welding tees, corners where outlet joins the run are well-rounded and perfectly smooth to minimize resistance to flow and to prevent trapping.

Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

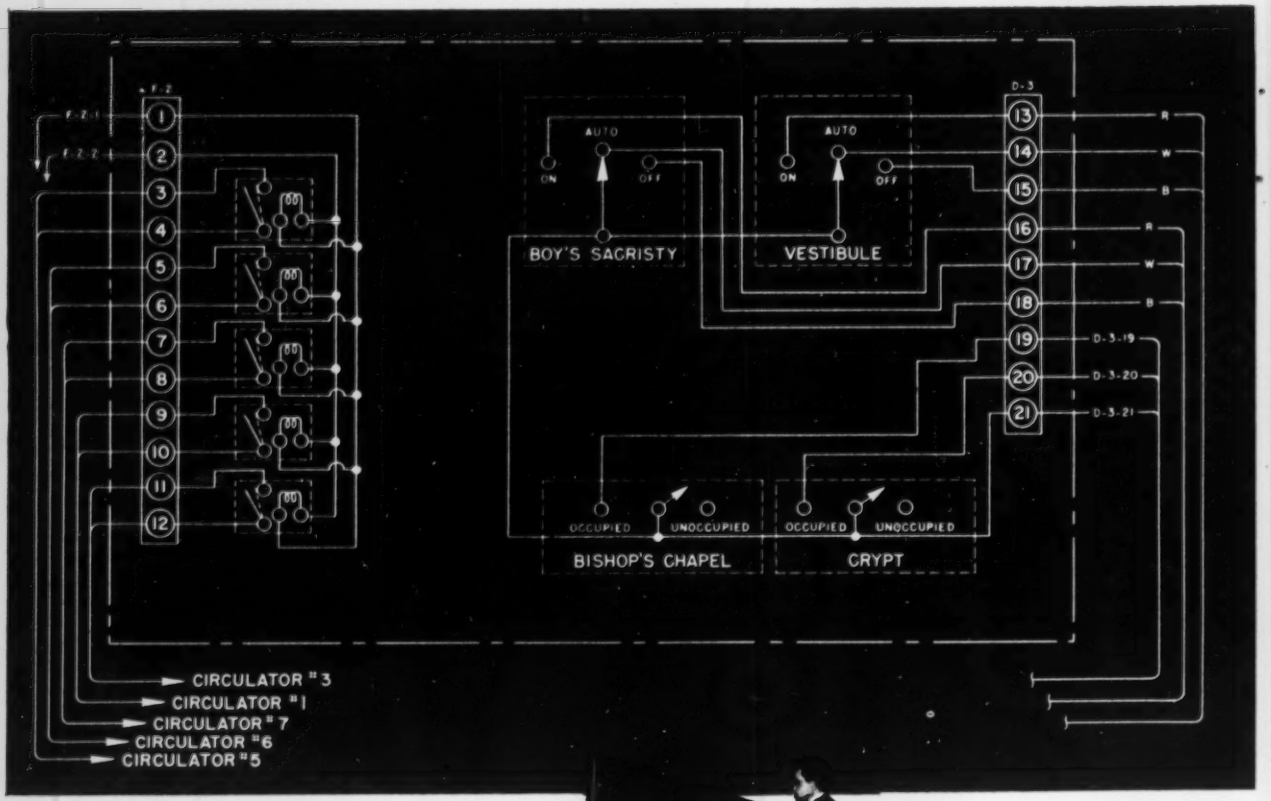
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

BARBER COLMAN

ELECTRIC Control Center

13-zone heating system in remodeled cathedral controlled by central panel "nerve center"

St. Mary's Cathedral, Fall River, Massachusetts. Interior redesigned by Maginnis & Walsh, with Richard D. Kimball Co., engineers in charge of mechanical design. Heating contractor, Fred Williams, Inc. Entire automatic temperature control system furnished and installed by Barber-Colman Company.



Simplified installation *results from Barber-Colman technique of employing a control center with prewired accessories—switches, relays, transformers, resistors, etc.—and numbered terminal strips for connecting all components of electric control system. Schematic drawing for one section of complete prewired cabinet (above) illustrates method.*

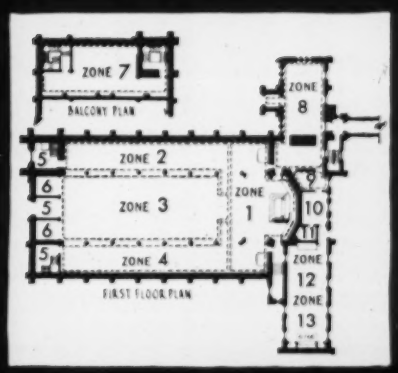
Serviceman *checks entire system from master temperature "Control Center" in the equipment room.*

Contractors seeking faster, cost-saving methods of installation . . . with "right-the-first-time" performance . . . are welcoming Barber-Colman's Electric Control Center which "packages the headache" of a control job.

Many a surprised engineer has discovered that this "Control Center" approach permits him to install a modern electric temperature control system—on large or small jobs—often at substantial savings.

A "Control Center" panel-cabinet is the key unit of the Barber-Colman system. Prewired internally, and housing all accessory equipment, this "nerve center" minimizes field errors, and permits complete check of system before delivery to the job. "Revisions" are easily made at the cabinet without running extra conduit or probing for junction boxes. Panel terminal strip numbers in the cabinet, plus numbered components, and numbered or coded wires, reduce wiring job to simple matching of corresponding numbers. Diagram showing conduit layout and number of wires required can be placed on bidding plans, resulting in realistic bids.

Heating system in remodeled St. Mary's Cathedral, Fall River, Massachusetts, is fully described with details of this modern method in illustrated brochure, obtained by sending the coupon below.



Beauty of St. Mary's interior design and practical efficiency of new heating system are credit to all concerned.

Outdoor reset thermostat actuates proportioning motor-operated valves (shown at right).

13 zones controlled—9 zones of floor panel radiant heating, 2 zones of direct radiation with convectors, 2 zones served by large capacity unit heaters.

Modern electric controls and engineering assistance are available at once from nearby Barber-Colman office.

BARBER COLMAN

ELECTRIC

Control Center

Automatic Controls • Air Distribution Products • Machine Tools • Small Tools
Molded Products • OVERdoors • Industrial Instruments • Textile Machinery

BARBER-COLMAN COMPANY, ROCKFORD, ILL., U. S. A.

Gentlemen: I'm interested in learning more about the St. Mary's installation and details of panel "Control Center."

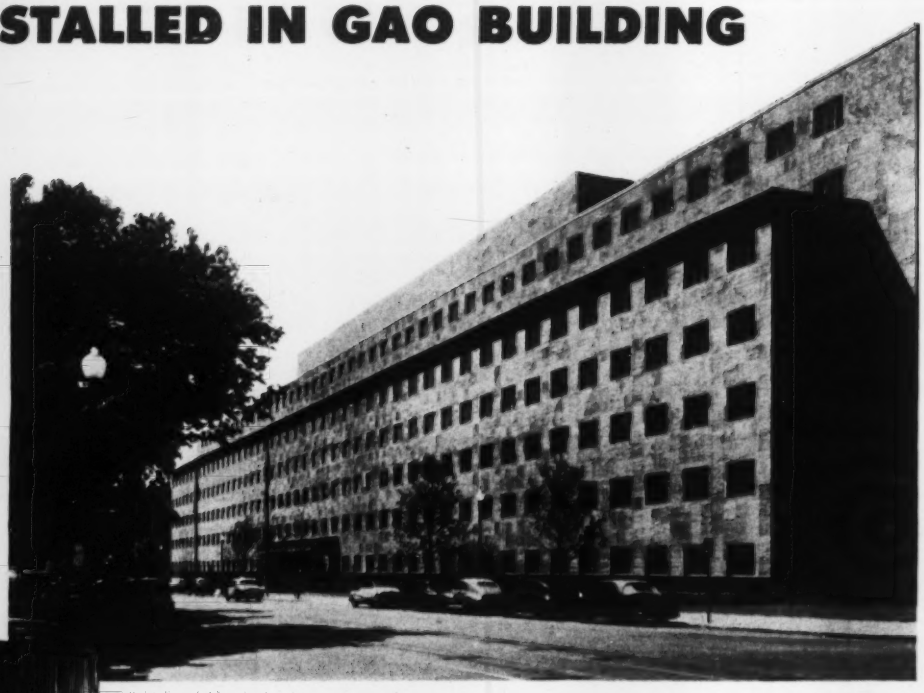
Name_____

Firm Name_____

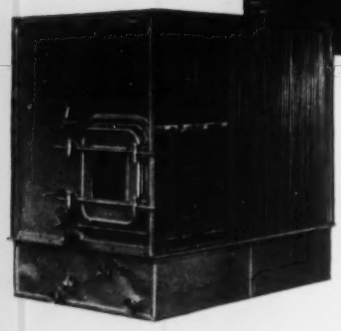
Address_____

City_____ State_____

47 Marlo DEHUMIDIFIERS INSTALLED IN GAO BUILDING



General Contractor:
John McShain Co., Philadelphia
Air Conditioning Contractor:
W. H. Singleton Co.
Architects and Engineers:
General Services Administration,
Public Buildings Service



MARLO Dehumidifiers are equipped to handle all humidifying, cooling and dehumidifying needs. Equipped with specially designed brass atomizing spray nozzles. Spray headers and risers of red brass pipe. Tank, casing and eliminators are cold rolled copper, all framing and structural members extruded brass.

The new $25,000,000 home of the General Accounting Office is, except for the Pentagon, the largest government building in the Washington area. It is a massive limestone structure, seven stories high, and covers an entire city block.

This unique "block-type" building has no wings or courtyards. Interior areas must depend upon air conditioning for proper ventilation.

Forty-seven MARLO Spray Type Dehumidifiers, with chilled water coils of approximately 4200 tons cooling capacity, were chosen for this gigantic task. Every minute, 1,000,000 cubic feet of "conditioned" air is carried to all parts of the building through 27 miles of ducts . . . keeping this "watchdog of the U. S. Treasury" alert at all times.

Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

April Showers every day in the year!
YOUR CUSTOMERS KNOW THAT CHASE MEANS QUALITY
When you install Chase Copper Water Tube, this ad gives you a sales plus. It tells the Chase quality story to 15,872,000 readers in the Saturday Evening Post and other leading consumer magazines.

For a refreshing shower with crystal-clear water and full-pressure... your home should have hot and cold water lines of Chase Copper Water Tube and Fittings.

Chase Copper Water Tube delivers a full flow of water. It can't clog with rust... it resists corrosion. Whether you're building a new home or replacing old pipe, use durable copper. For long life, at low cost, it's a far better buy than rustable pipe.

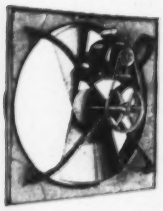
Ask your architect, builder or plumbing contractor about Chase Copper Water Tube. It's available through Chase plumbing and heating wholesalers served by 23 Chase warehouses across the nation. Chase Brass & Copper Co., Incorporated, Waterbury 20, Conn.

Chase

The Nation's Headquarters for
BRASS & COPPER
subsidiary of
KENNECOTT COPPER CORPORATION

CHASE BRASS & COPPER CO., WATERBURY 20, CONN., Warehouses and Sales Offices at:— Albany† Atlanta Baltimore Boston Chicago Cincinnati Cleveland Dallas Denver† Detroit Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester† St. Louis San Francisco Seattle Waterbury (†sales office only)

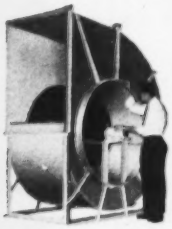
DIRECT DRIVE PROPELLER FANS—in sizes from 14" to 36", capacities up to 14,600 c.f.m.



BELT DRIVE PROPELLER FANS—in sizes from 24" to 54", capacities up to 36,000 c.f.m.

Rated Tops by heating and ventilating engineers!

HERMAN NELSON *propeller fans*



CENTRIFUGAL FANS—for every Class I or Class II use—slow speed or non-overloading types in 17 wheel diameters.

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AAF

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American Air Filter COMPANY, INC.

for commercial . . . institutional . . . industrial buildings.

Herman Nelson Fans have won recognition from engineers because they offer low operating costs. And because they have a low maintenance cost record.

One of many exclusive Herman Nelson features is the design of the fan blade. This blade has an "air foil" cross section with the pitch increasing toward the hub giving increased efficiency and quieter operation.

All Herman Nelson Fan blades are fabricated of aluminum and formed by the hydraulic pressure method. The flanged outer edge increases strength and rigidity.

This unique blade is an exclusive Herman Nelson development designed to provide functional operating advantages "rated tops" by commercial, institutional and industrial heating and ventilating engineers. We invite your inquiries for more complete information on these famous fans. Just write, wire or phone to: **Heating and Ventilating Products, Dept. HP-4, American Air Filter Company, Inc., Louisville 8, Ky.**

Certified Ratings

PFMA

CERTIFIED RATINGS

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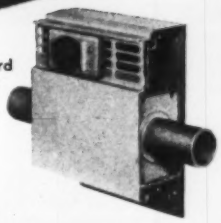
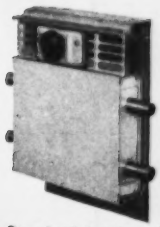
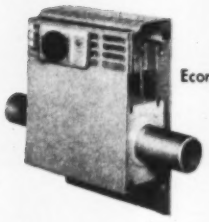
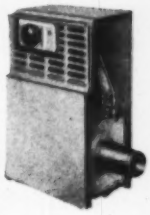
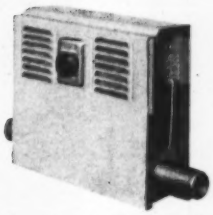
KRITZER DOES MAKE THE BEST!

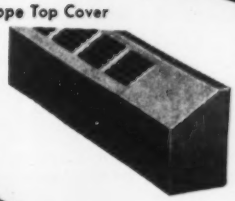

Universal Baseboard


Standard Baseboard

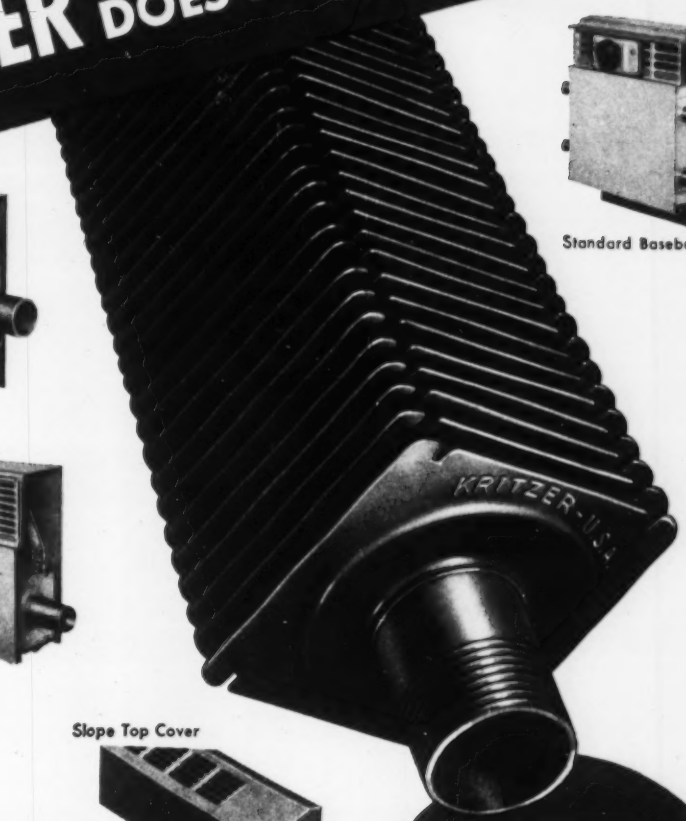

Economy Baseboard


Convector, Slotted Front


Convector, Louvered Front


Slope Top Cover

Flat Top Cover



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KRITZER RADIANT COILS, INC.

2901 LAWRENCE AVENUE · CHICAGO 25, ILLINOIS

✲ Kritzer Baseboard Heating · Kritzer Radiant Heating · Kritzer Fin-Pipe Heating

SEE YOUR JOBBER FOR KRITZER PRODUCTS

MASTER REFERENCE SAMPLE
No. 5 LOW LIMIT Air Flow at 100 psi.
.179
Cu. Ft./Min. at 60°F—30" Hg.
Corrected from
.186 Cu. Ft./Min. at 75°F 30.1" Hg.
O.D. .081 " I. D. .0304 " Length 11'6"
MASTER REFERENCE SAMPLE
No. 1 HIGH LIMIT Air Flow at 100 psi.
.205
Cu. Ft./Min. at 60°F—30" Hg.
Corrected from
.213 Cu. Ft./Min. at 75°F 30.1" Hg.
O.D. .081 " I. D. .0321 " Length 11'6"
ANACONDA
THE AMERICAN BRASS COMPANY
QUALITY CAPILLARY TUBES
Custom-Made To Specific Air-Flow Limits
For

ANACONDA QUALITY CAPILLARY TUBES:

Now custom-made to specific air-flow limits!

The true quality of every ANACONDA Capillary Tube is measured solely by its performance within specific mutually-agreed-upon air-flow limits. These limits alone are the base for production. ANACONDA Custom-Made Capillary Tube sizes are not confined to so-called standard inside diameters.

(1) To obtain the performance characteristics you require, simply submit your specifications or samples for the class of tube you need, cut if necessary to odd lengths, and *which have the desired limits of air flow.*

(2) From these we can readily determine the required correct nominal inside diameter and the overall tolerance for any given length to possess a flow capacity *within the range of these samples.* An optimum tube size and length may meet your requirements and show a saving in cost.

(3) As illustrated, your initial shipment will contain Master Reference Sample Tubes which have the maximum and minimum flow capacities agreed upon.

(4) Duplicate Master Reference Samples retained in our files are the means for assuring that every tube in all subsequent shipments will have air flow within the agreed-upon limits.

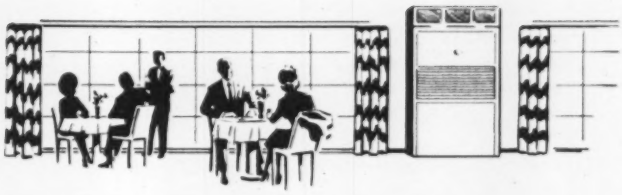
ANACONDA Custom-Made Quality Capillary Tubes are made of both copper and aluminum in nominal inside diameters from .005 in. to .090 in. For detailed information about these finely engineered tubes, write to The French Small Tube Branch, *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

5424

custom-made for precision

ANACONDA®

Quality Capillary Tubes



THERE'S A "STOUT HEART" IN THIS AIR CONDITIONER

The compressor is often called the "heart" of an air conditioner. And when you sell a Chrysler Airtemp "Packaged" Air Conditioner, your customer is getting a compressor that's unsurpassed. Here are some of the reasons why:

LONG EFFICIENT LIFE

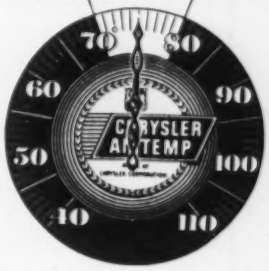
The precise machining and honing of vital moving parts cuts wear way down. Positive pressure lubrication reduces wear, too. The unique suction and discharge valve design gives top, sustained efficiency at high compressor speeds.

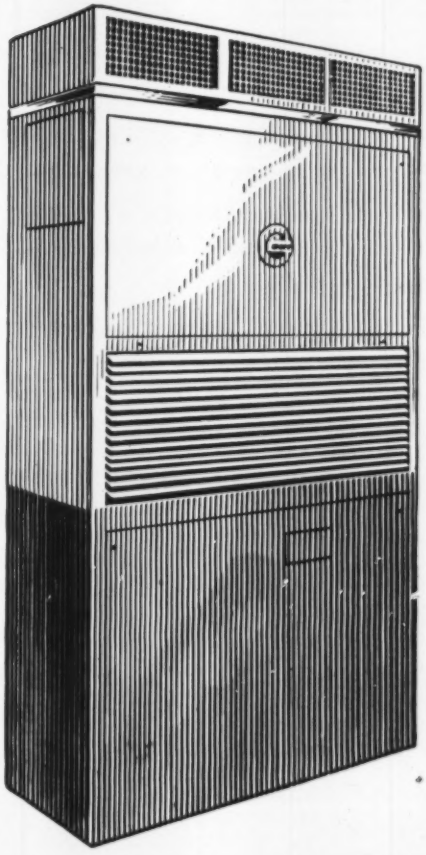
QUIET OPERATION

Vibration is reduced to a minimum because the radial compressor design permits perfect balance regardless of the number of cylinders.

Add one more important feature—machined, assembled and tested in a windowless, air conditioned factory, and you can easily see why the word "unsurpassed" in the first paragraph is not an idle claim—it's a fact!

Comfort Zone FOR PROFIT





"Packaged" Air Conditioners
Six models from 2 to 15 H.P. capacity. Meets every cooling need.

Guaranteed by Good Housekeeping

Chrysler Airtemp

HEATING • AIR CONDITIONING
***for* HOMES, BUSINESS, INDUSTRY**
Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

HP&AC-4-53

Airtemp Division, Chrysler Corporation
P.O. Box 1037, Dayton 1, Ohio

Please send full details on the Chrysler Airtemp Comfort Zone "Packaged" Air Conditioning proposition.

Name _____

Address _____ Phone _____

City _____ Zone _____ State _____

Iron Fireman

Dual or Triple Fuel Firing

changes fuels quickly fires oil, gas or coal

Central of Georgia Railway cuts steam costs 37% – saves $16,939 a year

J. H. Grayson, Shop Engineer,
Central of Georgia Railway Company

"WE LIKE TO SAVE MONEY and Iron Fireman firing has shown us the way to do it," says Mr. Grayson. "The first year we installed Iron Fireman Industrial Gas Burners with Iron Fireman Pneumatic Spreader stokers as standby firing we saved nearly $12,000 on fuel. In addition, we also saved over $5,000 on labor costs and I can honestly say we enjoy steadier firing, improved operation, and constant steam pressure 24 hours a day."

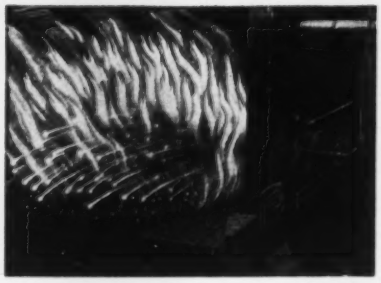
Burns all fuels efficiently

Efficiency ratings are high with oil, gas or coal. As price advantage shifts from one fuel to another your steam plant can shift with it—for the long pull if necessary. Or you can change fuels every day when desirable. This is routine practice in many companies where the gas supply is reduced during peak periods.

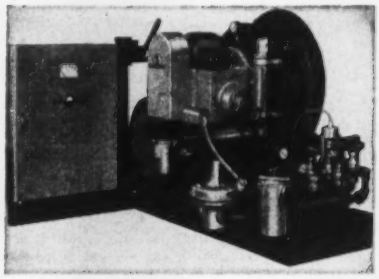
Avoid costly shut-downs

Fuel emergencies, due to interrupted or short supply, can be disastrous. Yet protection may cost little or nothing when offset by the fuel and labor savings of Iron Fireman multiple fuel firing.

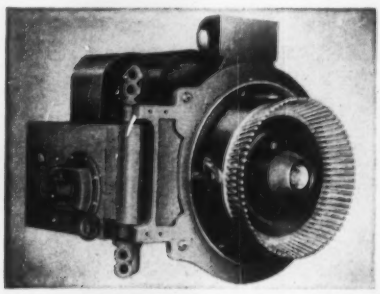
For further information write Iron Fireman Mfg. Co., 3066 West 106th Street, Cleveland 11, Ohio.



GAS, OIL, COAL. Equipment includes Ring Type gas burner, Rotary oil burner, and Pneumatic Spreader stoker. Coal is automatically dried, preheated and conveyed from bunker to boiler. No manual handling; no costly conveying equipment.



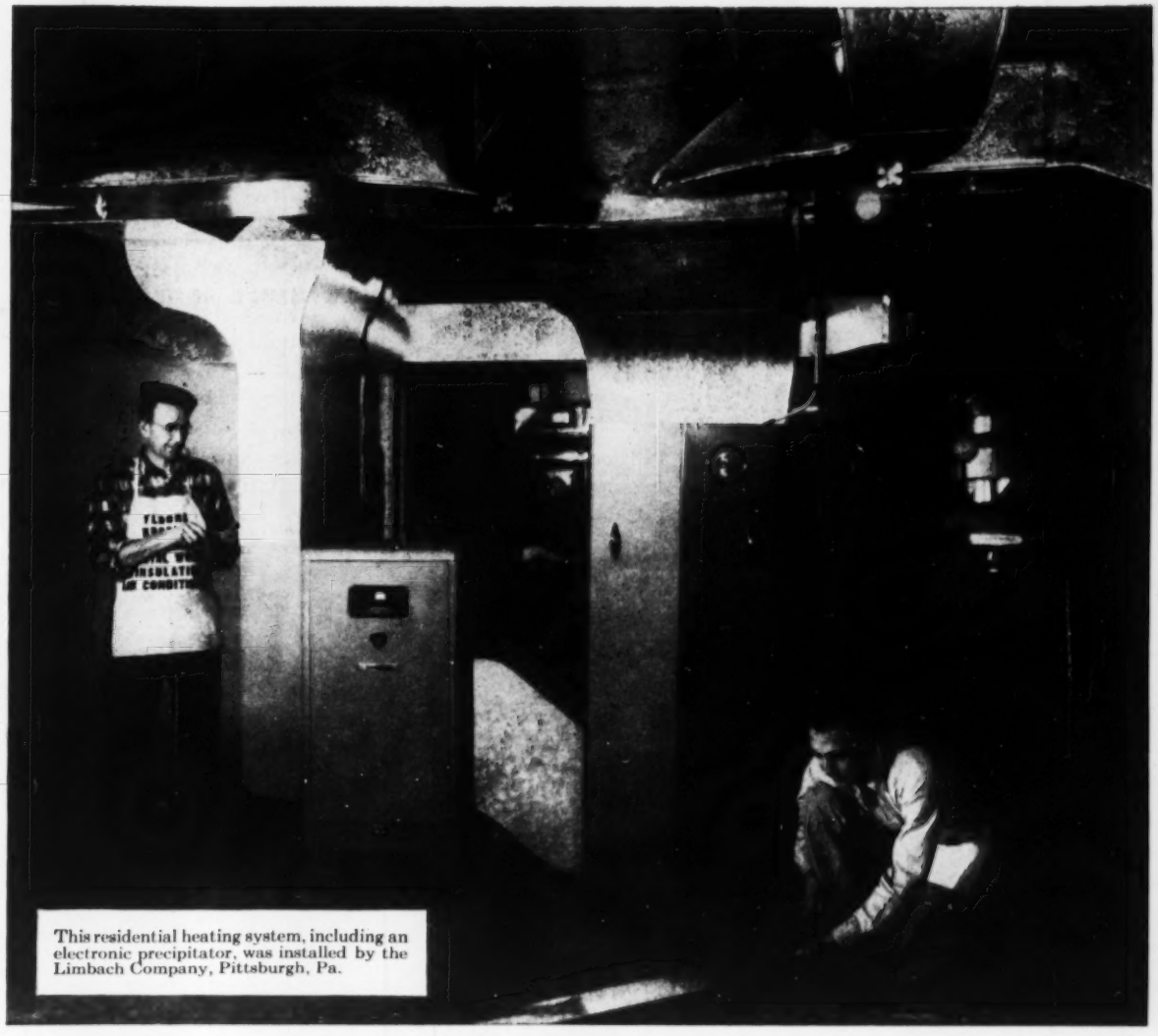
GAS-OIL PACKAGE UNIT. For Scotch marine and other types of boilers. Has integral forced draft and control panel which is completely wired and tested at factory.



GAS-OIL BURNER. Ring Type gas burner and Rotary oil burner on single mounting. Can shift fuels quickly with no loss of efficiency.

Iron Fireman

AUTOMATIC FIRING
FOR HEATING, PROCESSING, POWER



This residential heating system, including an electronic precipitator, was installed by the Limbach Company, Pittsburgh, Pa.

For tricky remodeling jobs . . . U·S·S Galvanized Steel Sheets

NEAT seams, tight joints and quality workmanship—on all sorts of new or modernization residential heating jobs—call for good sheets that handle easily, work up nicely. U·S·S Galvanized Sheets are uniform in ductility, flatness and surface finish; they make it easy to handle difficult shapes and angles on residential jobs like the one shown here.

You can bend, roll, cut or stamp these steel sheets in minimum time with satisfactory results. Soldering is no problem. And their tightly adhering zinc coating is highly resistant to cracking and flaking, assuring a long-lasting finish that contributes to the pleasing appearance and quality of every job you turn out.

U·S·S Galvanized Sheets are one of the best-known, most widely-used sheets in the industry. And the U·S·S trade-mark is your assurance of continuing dependable quality. Your customers know and appreciate the U·S·S name. It will pay you to take advantage of this widespread customer acceptance by using U·S·S Galvanized Steel Sheets on all your jobs.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
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U·S·S GALVANIZED STEEL SHEETS

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UNITED STATES STEEL

Tested patterns to meet today's needs . . .

Jenkins cast steel Valves

for dependable economy

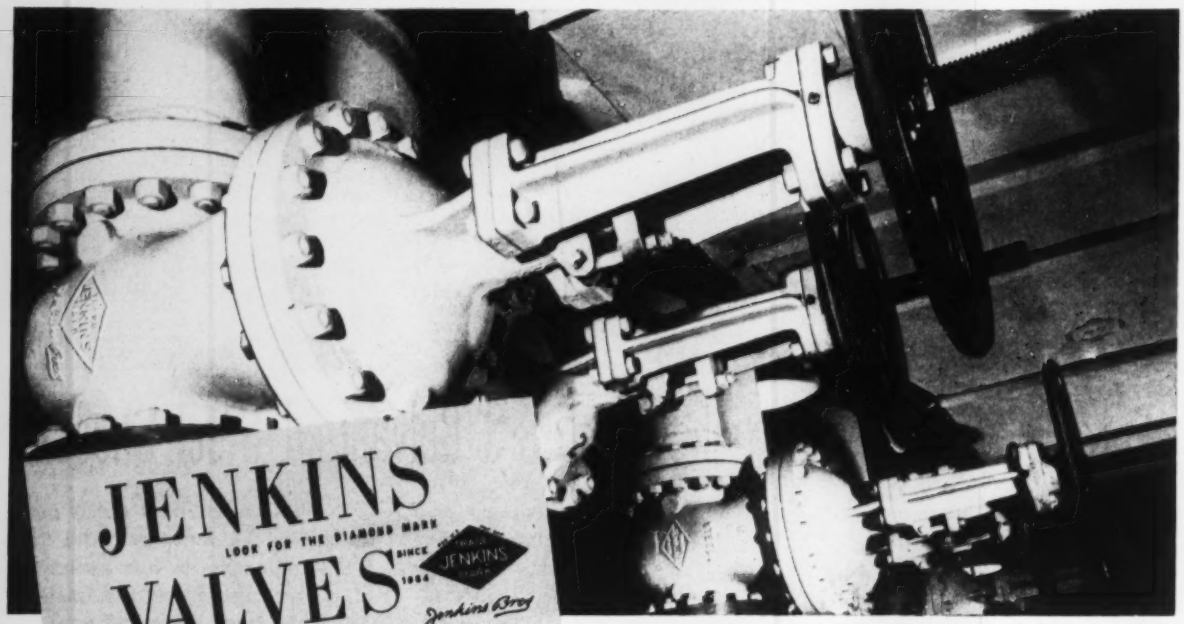
in higher pressure

—higher temperature services

Mounting pressures and temperatures in power generation and industrial processing call for Cast Steel Valves. For this increasing need, Jenkins offers a wide selection of patterns that have met the test of the toughest services throughout industry.

In these valves, Jenkins provides a wide margin of strength and safety beyond ratings. Special refinements in design extend their service life, assure long, trouble-free performance. Efficiency and low maintenance records measure up to the high standards established for all valves developed by Jenkins Valve *specialists.*

The new Cast Steel Valve catalog gives complete information. Write for your copy today. Jenkins Bros., 100 Park Ave., New York 17.



Get this NEW Cast Steel Valve Catalog

Describes Globes, Angles, Gates, and Checks with detailed pressure ratings, dimensions, and other technical data covering all patterns of Cast Steel Valves now available from Jenkins. Send the coupon for your copy.

JENKINS BROS., 100 Park Ave., New York 17

Please send catalog of Cast Steel Valves.

Name .....

Company .....

Address .....

.....

EQUIPMENT DEVELOPMENTS...

Fire Resistant Insulation Material

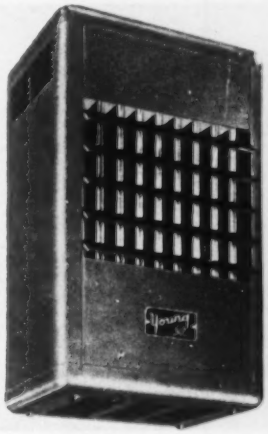
HPAC 1—"Firefoil" insulation material for use mainly in air conditioning plenum chambers. . . . Said to be suitable for temperatures up to 900 F, it is composed of corrugated asbestos felts. Other uses include machinery

housings, partitions, bulkheads in ships, coil housings, ovens and fireproof linings for elevator shafts. The insulation can be nailed, screwed or bolted in place and is cut with ordinary carpenter's tools. [Manufacturer: The Philip Carey Mfg. Co., Dept. FF, Wayne Ave., Lockland, Cincinnati 15, Ohio.]

Illuminator for Water Level Gages

HPAC 2—Mercury vapor lamp illuminator for flat glass water level gage readings. . . . A 100-watt sealed-in mercury vapor lamp emits a greenish blue color making it more visible to the eye. According to the manufacturer, water levels have been transmitted a distance of 125 ft. With the use of a light shield at the gage and suitable ducts, this distance can be increased. The mercury vapor rays also can penetrate foreign deposits on the mica which results in a longer gage service life. The entire unit consists of the illuminator and a ballast which can be plugged into a standard 120 volt electrical system. [Manufacturer: Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18.]

Above: Illuminator



Right: Heater

Gas Fired Unit Heater

HPAC 3—Gas-fired unit heater in seven sizes ranging in capacities from 70,000 to 230,000 Btu per hr input. . . . The heaters feature all-welded, aluminized steel combustion chamber and heat exchanger which, the manufacturer states, withstand the corrosive effects of gases and high temperatures thus preventing discoloration and scaling. Design features include a built-in draft diverter, four-bladed propeller fan, adjustable louvers, interchangeable burners for various gases, automatic pilot safety switch and temperature limit control, and a shutoff valve in the

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section: double asterisk, equipment and manufacturer not listed.

[4-53]

FOR YOUR CONVENIENCE

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1 2 *3 4 5 6 7 8 9 10 11 12 13 *14 15
16 17 18 19 20 21 22

Name ..... **Title** .....

Company .....

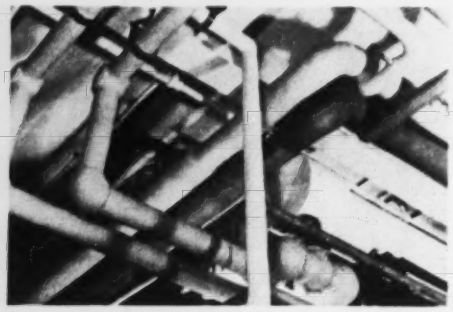
Address .....

City ..... **Zone** ..... **State** .....

pipe connection ahead of the controls. [Manufacturer: Young Radiator Co., 709 S. Marquette St., Racine, Wis.]

Colored Plastic Insulation for Pipes

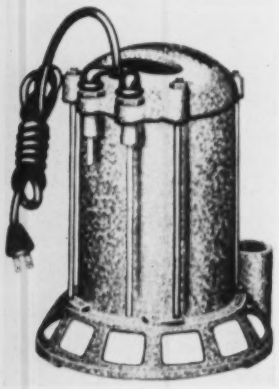
HPAC 4*—Plastic finish for pipes provides color identification and insulation in one application. . . . "Insulcolor" may be brushed or sprayed on insulated refrigerant, cold water, steam lines and insulated equipment. According to the manufacturer, it will withstand temperature to 160 F without cracking, shrinking or crazing and may be



used over heat insulations, cork pipe covering and lagging and as a finish over cork-insulated air conditioning ducts. It is available in white, light and dark green, light and dark blue, yellow and buff. [Manufacturer: Armstrong Cork Co., 440 Concord St., Lancaster, Pa.]

Submersible Sump Pump

HPAC 5—Submersible cellar drainer built for automatic submerged operation. . . . Pump is powered by a 1/3 hp capacitor motor hermetically sealed. Controls are by electrodes, with no moving parts. The pump can be installed through a 15 in. opening in pits 2 ft to 20 ft deep and is furnished with waterproof electric cable and plug. It is 13 in. high and 11 in. in diameter. [Manufacturer: Weil Pump Co., 1530 N. Fremont St., Chicago 22.]



Pump

Valve

Vent Valve for Hot Water Systems

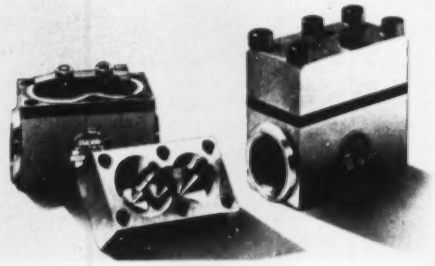
HPAC 6—Main vent valve, "No. 791," for hot water systems. . . . The valve provides continuous venting where operating pressure does not exceed 35 psi. It can be taken apart for cleaning or removal of dirt or compounds. Should dirt or cleaning compounds lodge between the float pin and seat, the valve cap can be screwed tight against the gasket to prevent water leakage until convenient to remove the valve. A drain tube connection can be furnished. [Manufacturer: Hoffman Specialty Mfg. Corp., 1001 York St., Indianapolis 7.]

Pipe Line Filters

HPAC 7—Four new small pipe line filter models designed for installations requiring 40 psi maximum pressures for compressed air or gas. . . . The filters feature one-bolt accessibility for inspection and cleaning without removing filters from the line. The "AA" series with absorption pad media remove traces of oil and water vapor. The "CH" series with radial fin inserts are designed to rid lines of dirt and pipe scale. [Manufacturer: Dollinger Corp., 11 Centre Park, Rochester 3, N.Y.]

Impulse Steam Trap

HPAC 8—High capacity impulse steam trap for use where condensate is handled in very large quantities. . . . The new "Series 50 Yarway" is a companion to "Series 60 and 120." According to the manufacturer, an important feature of these small, lightweight traps, is their ability to maintain high, even temperature in process



equipment. The trap employs a hinged lever and two valves mounted on a valve seat plate. The control flow which governs opening and closing action of the valves is obtained by allowing small clearance between inlet and outlet valves and their respective seats when the lever is at rest. [Manufacturer: Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18.]

High Temperature Insulating Blocks

HPAC 9—Industrial high temperature insulating blocks. . . . According to the manufacturer, "Supertemp P.V." blocks are suited for temperatures up to 1900 F, have greater breaking strength and provide great utility due to their lightness and ease in handling. The blocks are produced by a combination of vacuum and pressure techniques which cause the mineral wool fibers within the block to become felted and compressed. [Manufacturer: The Eagle-Picher Co., 900 American Bldg., Cincinnati 1.]

Liquid Chilling Unit

HPAC 10—Liquid chiller, fabricated and assembled at the factory. . . . Ranging in size from 10 to 60 hp, water cooling capacities are 22 gpm to 160 gpm through a 10 deg cooling range. Component parts are compressor, motor, gage board assembly, dual pressure control, condenser, chiller and heat exchanger. A thermostatic expansion valve, liquid line solenoid and strainer, liquid sight glass, fusible plug or relief valve, thermostat and charging valve plus interconnecting refrigerant lines are

Why CUMMINS ENGINE COMPANY specifies *Power-Flow* ROOF VENTILATORS

Embarking on a program of modernization and expansion for their plant at Columbus, Indiana, officials of Cummins Engine Company naturally planned for adequate, controlled ventilation.

Cummins started with four DeBothezat Power-Flow Roof Ventilators, selected for their low, streamlined appearance. This initial installation has been followed by many others until today 78 Power-Flows provide good ventilation for over 2,000 Cummins employees in machine shops and other production areas. 44 Power-Flows are for exhaust, 34 for air intake.

Why are the builders of world-famous Cummins Diesels so well satisfied with their roof ventilators? Because they found that Power-Flows perform exactly as advertised. The capacity ratings shown in our catalog are the capacities of the complete unit, including the weather head, NOT capacities of the fan alone. With Power-Flow Roof Ventilators you get all the air you pay for.

DeBothezat Power-Flow Roof Ventilator is a motor-driven fan in a weather-proof housing, for use with or without duct systems, either for air exhaust or intake. Available with fan wheels 12″ through 48″ in diameter, delivering up to 40,900 CFM. For catalog containing illustrations, specifications and certified capacity ratings, write our factory, Dept. HP-453, or phone your local DeBothezat agent.

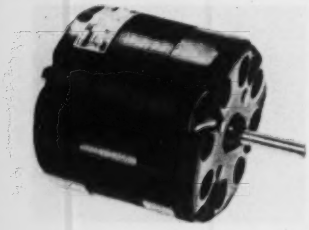
DeBothezat Fans

Division of
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

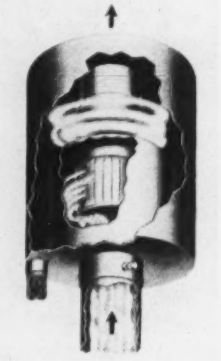
also included. Units of 30 to 60 hp can be fabricated and shipped knocked down. [Manufacturer: Baker Refrigeration Corp., 1508 Evans St., South Windham, Me.]

Motor for Air Conditioning Fans

HPAC 11—Model "4400" designed for fan duty in refrigeration and air conditioning applications. . . . A shaded pole motor, it is available in three stacking lengths, 1 in., 1½ in. and 2 in., for various output powers ranging from 1/25 to 1/11 hp. Currently the motor is being used in window-type ventilating fans. [Manufacturer: Electric Motor Corp., Div. of Howard Industries, Inc., Racine, Wis.]



Above: Motor



Right: Exhaust Head

Exhaust Head for Industrial Stacks

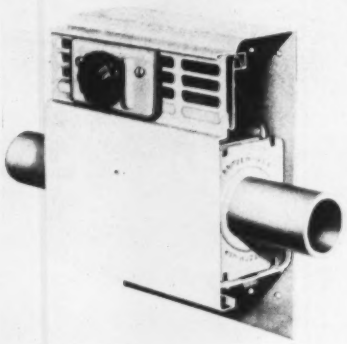
HPAC 12—Exhaust head, with no moving parts or filters, which cleans exhaust steam and vapors discharged by stacks. . . . A stationary centrifugal element imparts a carefully controlled but rapid rotational motion to the entrainment laden vapor. This action guides dirt particles, guck, oil and water outward to the walls of the purifier where it is drained to and ejected out the drain. The clean, dry steam continues upward and is discharged to the atmosphere. Although fabricated to specification, standard models have a slip-on or flange connection for the stack and a threaded connection for the drain. [Manufacturer: The V. D. Anderson Co., Dept. EH, 1935 W. 96th St., Cleveland 2.]

Flame Resistant Heating Tape

HPAC 13**—Flexible, flame resistant heating tape for pipes, tubing and fittings. . . . "Ribbon Heat Aeronautical" comes in tapelike form about ½ in. wide and 0.1 in. thick. Manufactured by Cox & Co., Inc., it is said to be completely and indefinitely waterproof and not affected by prolonged exposure to oil, grease, gasoline, mild acids or alkalies. Heat is produced by passing current through four fine fuse wires which are protected by a fiber glass braid impregnated with polyethylene. Additional protection is provided by an exterior jacket of vinyl-chloride. At one end of the tape the wires are connected to form an electrical circuit. At the opposite end, the wires are connected to a pair of non-heating leads. [Distributed by: Air Associates, Inc., Teterboro, N.J.]

Baseboard Heating Equipment

HPAC 14—"Universal" baseboard for steam or hot water systems. . . . Features include steel back plate which aligns the entire baseboard assembly. A support bracket snaps onto the back plate to support upper and lower edges of the front cover and carries the slide cradle. This



slide cradle fits close to the fins and prevents movement of the coil unless necessary for realignment. After alignment, the cradle moves with the coil on the ribbed bracket. Front plates snap onto the assembled support brackets and back plate to complete the enclosure. [Manufacturer: Kritzer Radiant Coils, Inc., 2901 Lawrence Ave., Chicago 25.]

Filter for Oil Burners

HPAC 15**—Fuel filter for small and medium-sized oil burners. . . . "Micronic" filter features a depressed head for non-spill removal of the replaceable element that is designed to trap all dirt, tank and pipe scale, and solid impurities exceeding a dimension of 5 microns. The manufacturer states that the replacement element has over 200 sq in. of filtering surface and gravity flow capacity of more than 100 gph. [Manufacturer: Purolator Products, Inc., Rahway, N.J.]

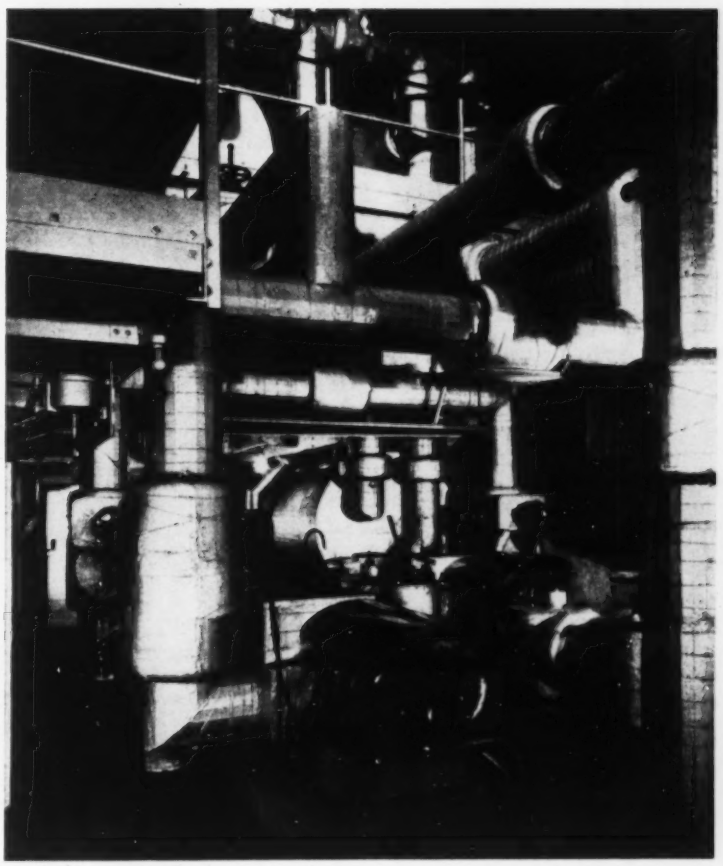
Rotary Masonry Drill

HPAC 16**—Drill provides clean holes in concrete walls, floors, columns and ceilings. . . . A recent improvement includes a specially designed collar which is standard on all drills of ⅞-in. diameter or larger. This improvement facilitates changing of shanks when different length drills are required. All drills of ⅞-in. diameter or larger have

interchangeable shanks. Another new feature is the worm which starts right at the grinding inserts. This worm withdraws the pulverized residue from the hole and carries it away. The drills are made in standard diameters from 3/16 in. to 5 in. and are available up to 8 in. on special order. [Manufacturer: Termite Drills, Inc., 99 N. Lotus Ave., Pasadena 8, Calif.]

[*Continued on page* 218]

How old is the insulation on these cold lines?



With proper application and maintenance, Armstrong's Cork Covering will last a long, long time. As an example, look at the lagging and molded fitting covers on these brine lines at Consolidated Cold Storage, Inc., cold storage warehouse in Baltimore, Md. The insulation is dry and efficient. It fits tightly against the pipes. In fact, the entire job looks as good today as when it was first installed back in 1929—24 years ago.

Since that time the covering has been inspected every year. Broken wires have been replaced, gouges or scars patched, and the entire installation given a good coat of aluminum paint. The cost of this program is small compared to the value of the insulation or its replacement cost.

This job is by no means unusual. There are hundreds of cork installations, both on cold lines and in cold rooms, that are still giving excellent service after as long as 20, 30, or even 40 years.

Because low-temperature insulation is a long-term investment, it pays to call on Armstrong whenever you have insulation work to be done. The Armstrong organization can take over all phases of the work for you—from correct specifications to skilled application. You are sure of a thoroughly professional job that means long, low-cost service. For further information, just contact your near-by Armstrong office or write Armstrong Cork Company, 4404 Concord Street, Lancaster, Pennsylvania.

Complete Insulation Contract Service

There are many factors that can't always be written into an insulation contract, but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility—resources to complete the contract despite any unforeseen events.

2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.

3. Technical ability — experience plus technical and research staff to do the job in accordance with best practices.

4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.

5. Efficiency — ability to deal with problems of accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

ARMSTRONG'S INDUSTRIAL INSULATIONS

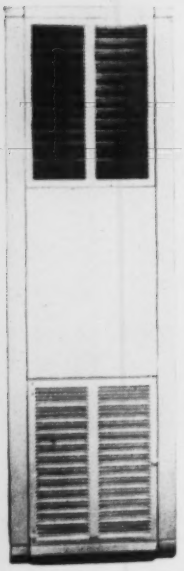
For temperatures from 300° below zero to 2800° F.

JOHN ZINK

JZ

HEATMAKERS

for all DOMESTIC HEATING NEEDS

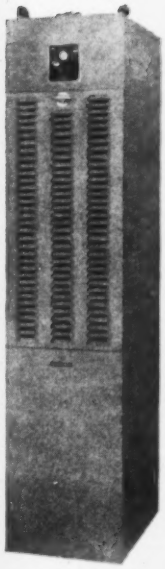


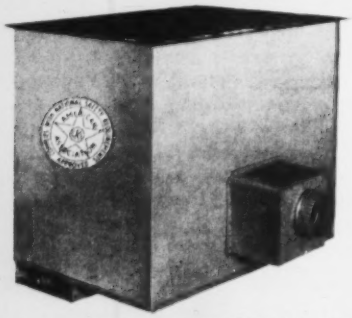
WALL HEATER

John Zink's new WH-25 Recessed Wall Heater fits standard 2" x 4" stud partitions on 16" stud centers, is barely 58" high. Attractive modern design and finish. Available in standard and radiant styles.

CENTRAL HEATER

John Zink Central Gas Heaters are available in Vertical or Horizontal Forced air models. Suitable for installation in attic, closet, basement, utility room, under the floor, or as a suspended heater. Attractively finished.





FLOOR FURNACE

John Zink Gas Fired floor furnaces are available in 5 conventional and short models with input ratings from 30,000 b.t.u./hr. to 85,000 b.t.u./hr. When equipped with safety pilot and automatic temperature control they are a complete heating plant in a package.

STREAMLINED LUMINOUS FLAME

CONVERSION BURNER

Easy to install. Operates manually or automatically. Burns clean fuel—natural, mixed, manufactured or LP gases — without soot or smoke. Luminous flame radiates heat two to three times faster than a blue flame. Four sizes available for either vertical or horizontal firing.

Write for Literature

Engineered FOR SMOOTH FLOW

TUBE-TURN Eccentric Reducers are designed with strong knuckle contours and as gentle transitions from large to small diameters as possible. In addition to providing smooth inner walls at the joints, these features hold turbulence and pressure loss to a minimum.

Efficient piping flow reduces pumping power requirements, and investment in equipment. For efficient, leakproof piping, specify welded systems—using TUBE-TURN Welding Fittings and Flanges.

You'll find a TUBE TURNS' Distributor in every principal city. Call him for good service in good connections.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

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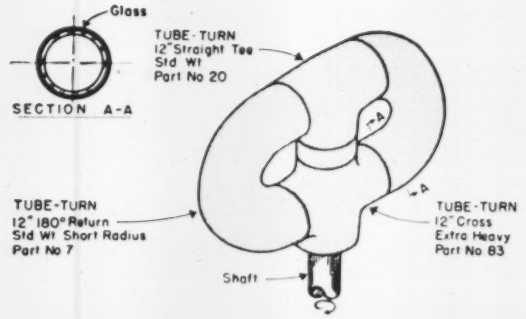
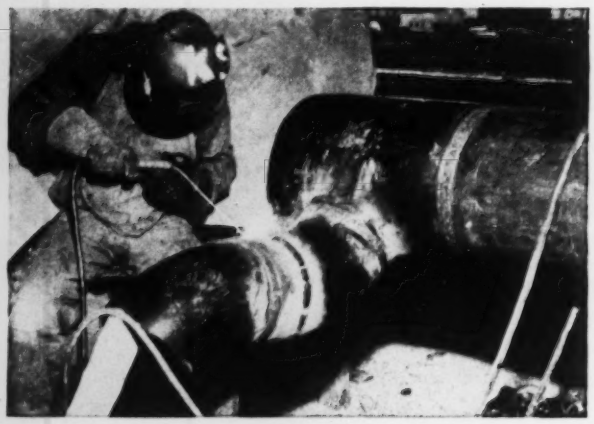
ENGINEERING SERVICE

TUBE TURNS' *Engineering Service*
HELPS SOLVE A VIBRATION PROBLEM

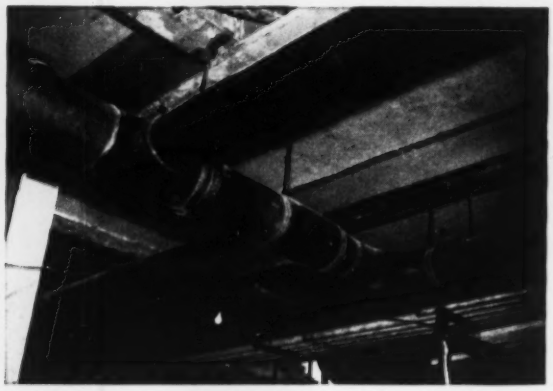
TUBULAR CONSTRUCTION often solves tough machine design problems and here, as in piping problems, Tube Turns' Engineering Service is ready to help you! For example:

Vibration was cracking the glass coating of a plate type agitator for a brine tank in a chemical plant. After repeated replacements, the engineers decided to switch to tubular construction and called in Tube Turns' Engineering Service for design assistance. The resultant design, shown in the sketch, embodies great rigidity and is not affected by the vibration. The expensive maintenance caused by cracking of the agitator's glass coating was eliminated.





FABRICATION IS FAST. Field or shop fabrication of piping assemblies is easier when welders can count on the dimensional accuracy of TUBE-TURN Welding Fittings. True circularity and uniform wall thickness assure perfect lineup and fit.



AT GENERAL ELECTRIC. Two 16-inch steam mains, at boiler plant of the new G-E Appliance Park in Louisville, will help distribute 900,000 pounds of steam per hour efficiently. Welded piping, using TUBE-TURN Welding Fittings and Flanges, was specified for all critical lines in the new plant: high and low pressure steam, gas, domestic and mill water, and compressed air.

TUBE TURNS, INC., Dept. A-3
224 East Broadway • Louisville 1, Kentucky

Your name .....

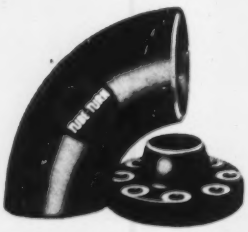
Position .....

Company .....

Nature of business .....

Address .....

City ..... *State* .....



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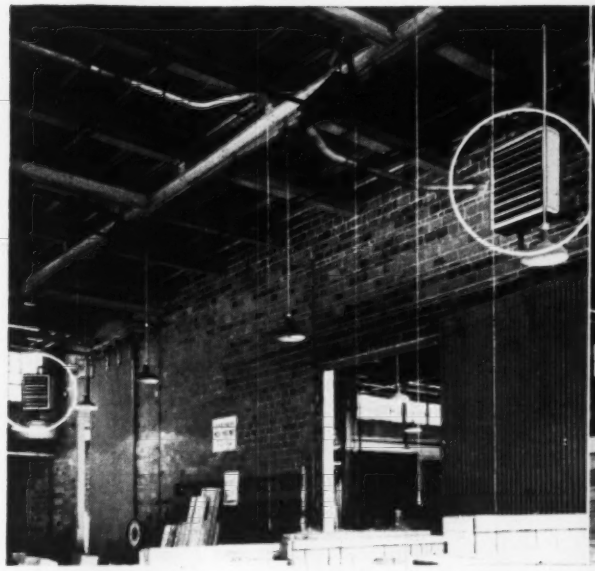
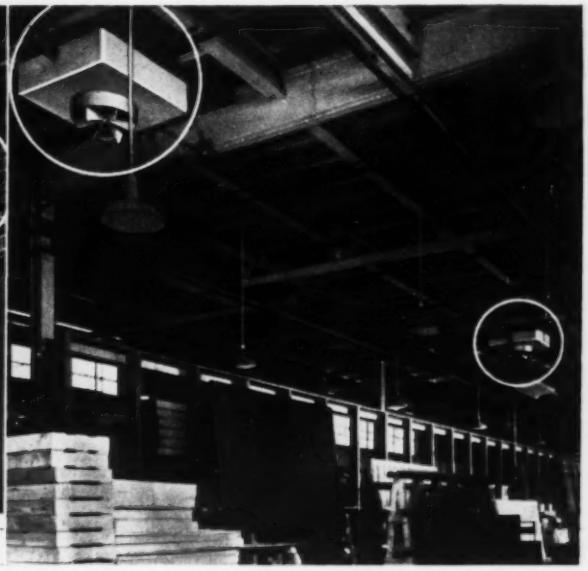
LOUISVILLE 1, KENTUCKY



AIRTHERM Horizontal Discharge Unit Heaters installed on the loading platform of Pittsburgh Plate Glass Company.



AIRTHERM Vertical Discharge Unit Heaters installed in the Pittsburgh Plate Glass Company warehouse.

For "TAILOR MADE" Temperature In Every Department...

Airtherm STEAM UNIT HEATERS

Were Chosen for PITTSBURGH PLATE GLASS CO.

ST. LOUIS, MISSOURI

Here's another example of how the complete line of AIRTHERM Steam Unit Heaters can give you truly *flexible heating* to meet the many different requirements in factories, warehouses, garages, super markets, schools, offices, bowling alleys and similar buildings.

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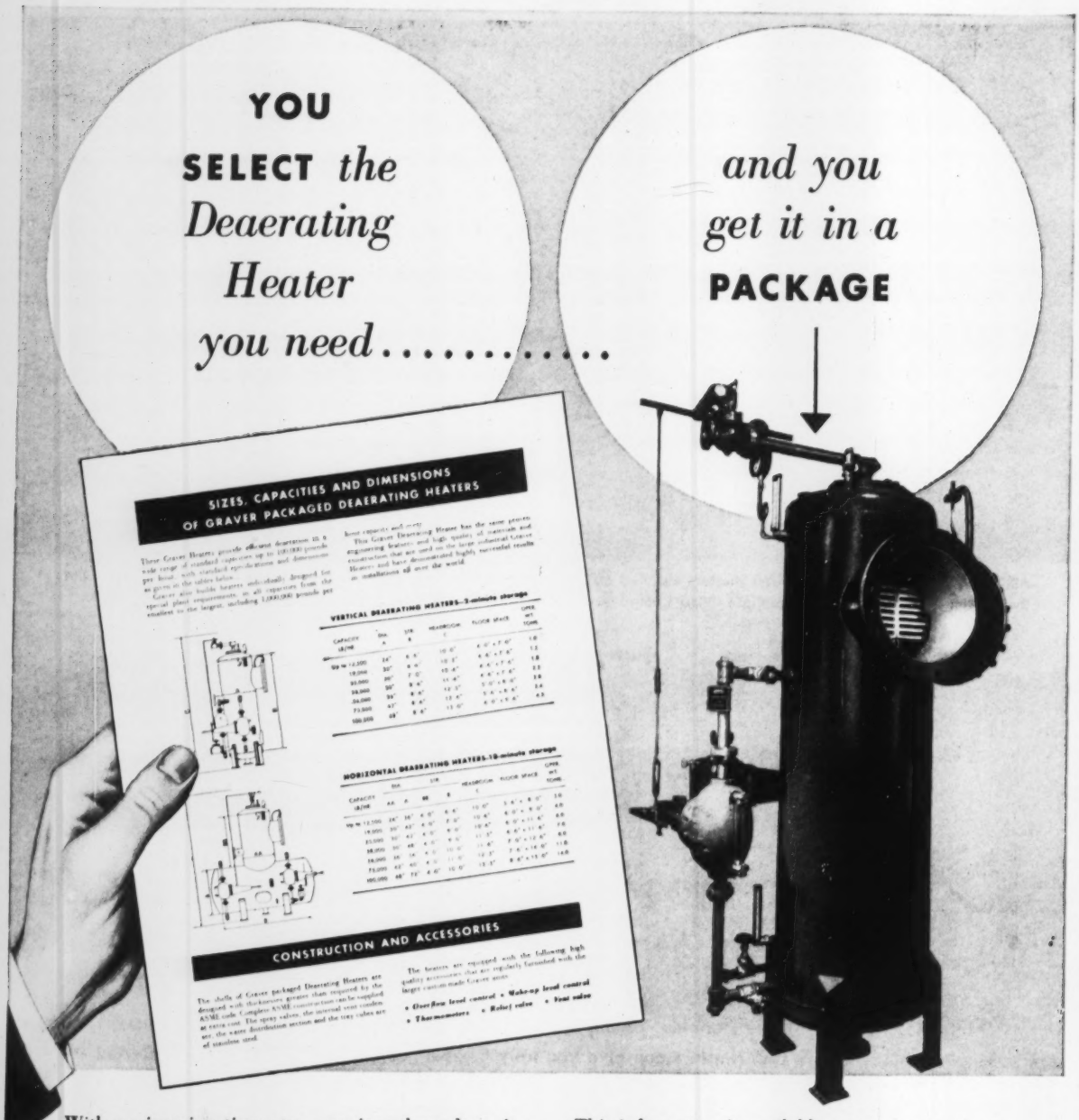
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This information is available to you upon request, together with complete description of the Graver Deaerating Heaters which are furnished as a package . . . with all internal parts, controls, valves and instruments you need for the installation. Your request for this information will not involve the slightest obligation on your part.

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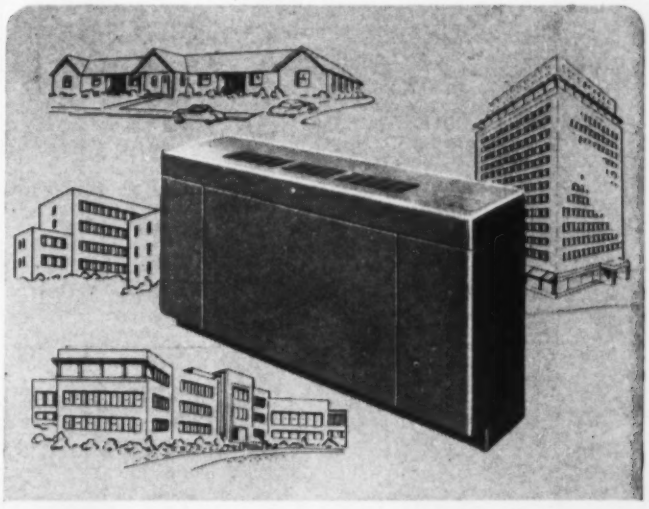
GRAVER *Deaerating Heaters*

Here's the answer to simple, efficient, economical year 'round air conditioning

The REMOTAIRE
by AMERICAN-Standard

a new remote type unit for multi-room installations



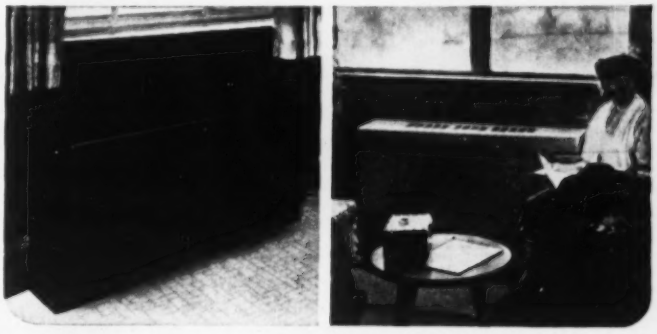
Heats in Winter
Cools in Summer

■ The Remotaire is an individual room remote type unit for providing year 'round air conditioning for central plant multi-room installations.

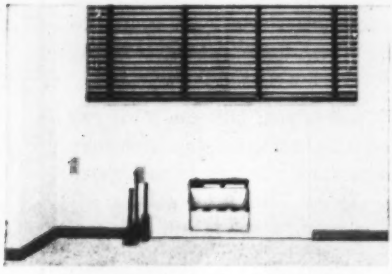
The Remotaire, as part of a Remotaire system, uses chilled water from a central water chiller for cooling and hot water from a central heating plant for heating. Individual control of each unit allows the occupant to choose the room temperature that suits him best without affecting adjoining spaces.

The Remotaire is enclosed in an attractive cabinet of sturdy, reinforced steel—plus a reinforced air grille—which adds to permanence and long-lasting beauty of unit. Designed for location under windows, this unit can be free standing or recessed into wall four inches.

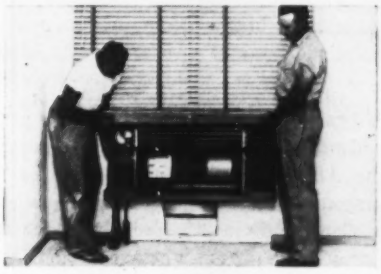
For hotels, motels, apartments, hospitals, offices and industrial buildings and other types of installations.



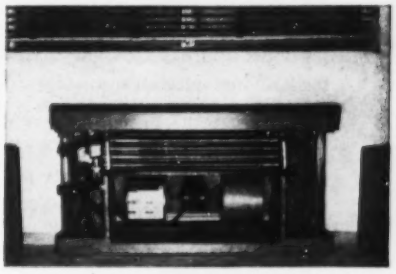
The REMOTAIRE Wall Aperture System is ideal for New Construction



LOCATION READY for Remotaire shows wall aperture, water supply, return, and condensate pipe stubs, and wall plug for electrical connections.



REMOTAIRE is set in place and leveled. Piping and electrical connections are made and pipe insulation applied.



HERE IS THE REMOTAIRE (with panels removed) showing the piping and electrical connections and pipe insulation completed.

As shown in the pictures above, the Remotaire, as part of a Remotaire Wall Aperture System, can be readily installed in the average building since piping connections are the principal installation requirement. Ventilation air is introduced through a small wall aperture behind each unit thus eliminating use of large, expensive, space-consuming ductwork. Other Remotaire systems, using other methods of ventilation, are ideal for modernization as well as new construction. Write for Remotaire Brochure, Form 298.

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Standard boiler return systems—Pree-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

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Now available in pipe covering and block insulation, Mundet Custom-Molded 85% Magnesia permits new heat-saving efficiency.

You benefit from these advantages when you use Mundet 85% Magnesia Insulation.

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  It cuts easily and cleanly, even without canvas support. No chipping, crumbling or "powdering." Blocks score cleanly.
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  Only 11 lbs. per cubic foot density. Even larger sizes and thicknesses are easy for one man to handle.
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  Precision manufacture on the latest type of equipment insures uniform standards.
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  Greater "ductile strength" is built into the insulation. It does not "powder," settle or disintegrate even with heavy vibration. It withstands handling and may be removed and reapplied if necessary.
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  No spaces are left for the escape of heat. The whole heated surface is snugly enclosed.

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INSULATION FOR HIGH AND LOW TEMPERATURE

Shown on the right is a GENERAL BLOWER installation of forced draft fans for the Middletown State Hospital.

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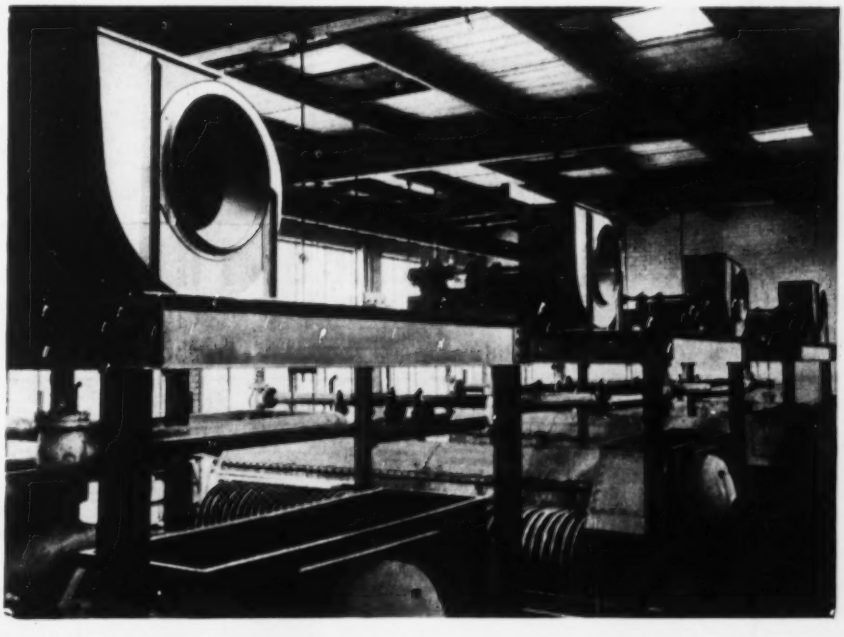
Power plus rugged construction, faithful round the clock operation and scientific engineering make GENERAL BLOWERS a must for your next heating installation. Whether it is a heating or ventilating installation, individual care is given each blower to guarantee you the most efficient blower that can be purchased.



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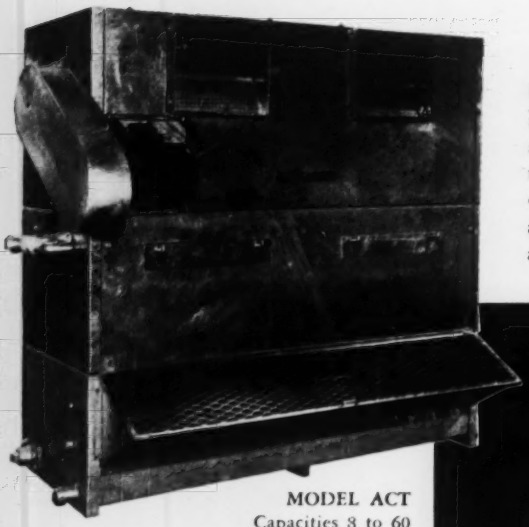

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Capacities 8 to 60 tons. 25 ton unit shown.

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Acme's heavy duty all metal eliminators produce maximum changes in direction of air flow while removing entrained water droplets with low static loss. The new heavy gauge steel "Acme-Pak" is designed to provide the maximum in cooling effect.

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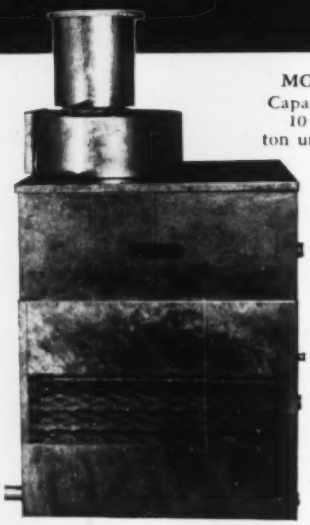

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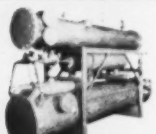

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Continuously serving the refrigeration and air conditioning industry since 1919

OUT OF SIGHT—OUT OF MIND—

Conduit containing 10 pipes in typical installation. Contains no joints, no voids. Z-Crete is as permanent as the earth itself!

Permanently!

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Only Z-Crete, the Modern Monolithic Insulation, Makes It Possible to Insulate a Job and Forget It!

Z-Crete, the lightweight, resilient, insulating concrete specially designed for underground heated piping *you can install and forget!* It's as permanent as the earth itself.

Z-Crete's stability and high water resistance make it a good protector against pipe corrosion, as well as an excellent insulator. It is poured directly and monolithically around the piping, eliminating joints or voids. Fireproof, rotproof and verminproof, Z-Crete serves a dual purpose—the insulating concrete is both the structural conduit and the insulation. Any number, size, or arrangement of pipes can be designed into a Z-Crete conduit. Inquire today . . . there's an experienced, licensed applicator near you!

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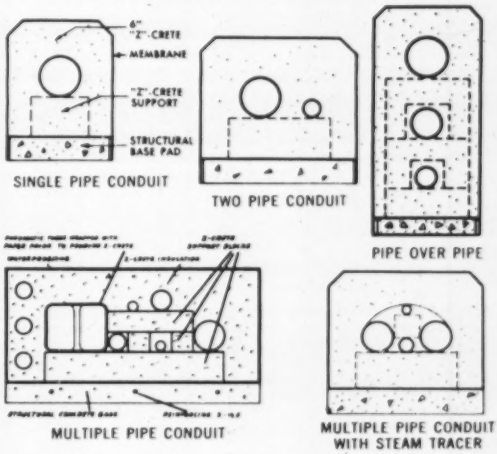

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Monarch
SPRAY NOZZLES

for AIR WASHERS . . . COOLING TOWERS

Fig. 631

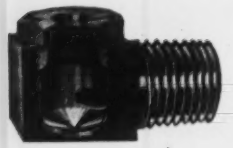

Fig. 629

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from ⅛" to 1". ¼" size is 1-⅝" long and made from ⅝" square stock.

CAPACITIES: GALLONS PER HOUR

Sizes			Lbs. Operating Pressure					
Pipe	Orifice	Lead	10	20	30	40	60	100
	69	69			2.9	3.3	4.0	5.1
	61	61		4.0	5.0	5.5	7.0	8.7
⅛"	61	53	4.4	6.2	7.5	8.3	10.3	13.0
OR	53	53	5.8	8.2	9.8	10.9	14.1	17.3
¼"	49	49	9.1	11.1	13.2	15.0	19.5	24.6
	3/32"	3/32"	11.8	16.6	20.4	23.4	29.0	36.5
	1/8"	1/32"	19.5	27.6	33.3	39.1	49.0	60.0
	1/8"	1/8"	24.3	34.6	42.8	50.0	64.0	78.5
	7/64"	1/8"	31.5	46.1	57.0	64.1	81.9	105
	3/16"	5/32"	52.2	75.0	92.5	109	138	189
¼"	7/32"	5/16"	78.0	112	138	163	205	257
	7/32"	7/32"	82.0	121	152	180	225	300

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The H-261 and F-80 brass water nozzles produce the finest, softest, fog-like spray possible with low direct pressure only. Popular sizes are nozzle #3.00 and #5.00 tested either 80° or 120° at 25 pounds.

All Brass construction with 120 mesh Monel screen strainers and ⅛" or ¼" female or ¼" male pipe connection in the F-80 and ¼" male only in the H-261. The H-261 is 1-3/8" overall and the F-80, 1-7/8".

Fig. H-261

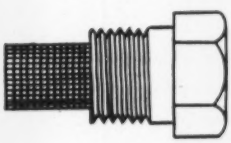
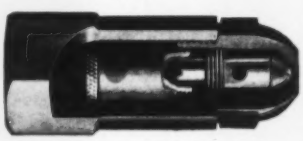


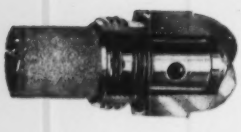
Fig. F-80



GALLONS PER HOUR

Nozzle No.	Lbs. Operating Pressure				
	25	40	60	80	100
1.35		.57	.69	.83	.92
1.65		.75	.89	.99	1.12
2.00		.94	1.14	1.28	1.40
2.50		1.13	1.45	1.64	1.86
3.00	1.03	1.39	1.62	1.85	1.95
3.50	1.36	1.77	2.11	2.46	2.80
4.00	1.56	2.00	2.42	2.77	3.16
4.50	1.86	2.32	2.77	3.21	3.68
5.00	2.20	2.88	3.57	4.09	4.59
5.50	2.22	2.96	3.75	4.31	4.78
6.00	2.55	3.35	4.01	4.78	5.23
7.00	2.90	3.91	4.60	5.17	6.00

OIL BURNERS



Monarch Stainless Steel Nozzles for high pressure gun-type oil burners are the industry yardstick for nozzle performance. Each nozzle individually tested for capacity, spray angle and uniformity of spray on No. 2 fuel oil weighing 7.16 pounds per gallon at 74°F. and 34 S. S. U. viscosity at 100°F. Standard spray angles are 30°, 45°, 60°, 70° and 80° in small sizes.

Standard capacity sizes (GPH at 100 psi.): .60, .75, .85, 1.00, 1.20, 1.25, 1.35, 1.50, 1.65, 1.75, 2.00, 2.25, 2.50, 3.00, 3.50, 4.00, 4.50, 5.00, 5.50, 6.00, 6.50, 7.00, 7.50, 8.30, 9.50, 10.50, 12.00, 13.80, 15.30, 17.50, 19.50, 21.50, 24.00, 28.00, 30.00 to 60.0 in 5.00 GPH steps and 60.0 to 100.0 in 10.00 GPH steps.

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THROUGH NARROW OPENINGS!

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BOILER

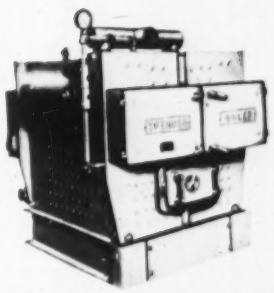
An outstanding success! Here's why Spencer's new boiler, introduced a few short months ago, has already won wide acceptance:

In existing buildings—divided design permits entry through narrow basement openings. No tearing out of walls. The two watertight sections can be moved in separately, yet require no welding for installation.

In new buildings—overall height of this new boiler is approximately 25% less than conventional firebox boilers . . . makes possible lower basement ceilings . . . cuts down excavation expenses.

Other time-tested Spencer advantages: It's *quickly convertible* from mechanical to hand firing. It's *fast steaming*, thanks to its staggered rows of fire tubes. It's *self-cleaning*. Has a high firebox and *instantaneous or tank-type service water coils* in a wide range of capacities.

Only one of Spencer's Quality Line of Commercial and Residential Boilers



Spencer's Divided Low-Waterline Boiler is available in sizes from 3,500 to 42,500 sq. ft., steam.

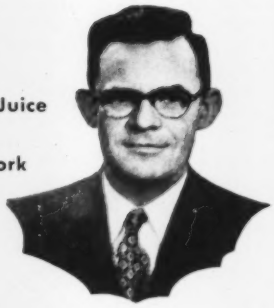
SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

THERE IS A SPENCER FOR EVERY BUILDING . . . FOR EVERY FUEL

"WE GET BIG SAVINGS BY BURNING COAL THE MODERN WAY!

Other fuels would cost us far more!"

says
Mr. A. J. Monta,
Plants Engineer,
The Welch Grape Juice Company, Inc.,
Westfield, New York



"We analyzed the cost of coal and other fuels before modernizing our power plant. The result is this up-to-date coal installation that delivers steam at half the cost of competing fuels. *For economy you can't beat* bituminous *coal burned the modern way!*"

Modern coal-burning and handling equipment saves this plant more than 35% on labor alone! New stokers, boilers, controls and coal-handling equipment cut labor costs and save this plant 18% on fuel. The complete installation will pay for itself in about 6 years.

● Burning bituminous coal the modern way can save you money, too! Labor costs are cut to a minimum with up-to-date coal- and ash-handling equipment... modern combustion installations deliver anywhere from 10 to 40% more power from every ton of coal!

That's why, if you're planning to modernize or build a new plant, it will pay you to get the latest facts on coal. Let a consulting engineer show you how a modern coal installation designed to meet your specific needs can save you real money.

Here's something more! Today's bituminous coal customers get a better-prepared product—designed to meet their special requirements. And bituminous coal offers future dependability no other fuel can match. Reserves are virtually inexhaustible, and America's coal industry is the world's most efficient —your assurance of dependable supply of coal at relatively stable prices for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

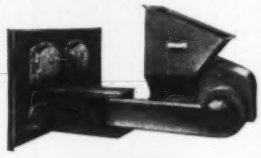
THERE'S A CANTON STOKER TO MEET EVERY MODERN NEED—ECONOMICALLY

CANTON STOKER CORPORATION

Specialists in **Automatic Coal FIRING, HANDLING and CONTROL Equipment**

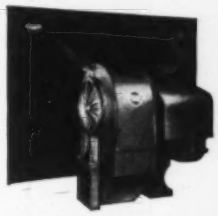
CALL THE REPRESENTATIVE NEAREST YOU

HERE ARE THE OUTSTANDING TYPES, SIZES, STYLES BEING SPECIFIED TODAY . . .



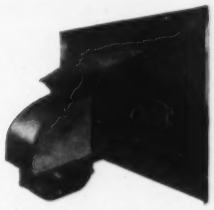
THE DURAFLEX DELUXE WORMFEED

Includes ash dump grates, unit or divided drive. For loads up to 275 H. P.



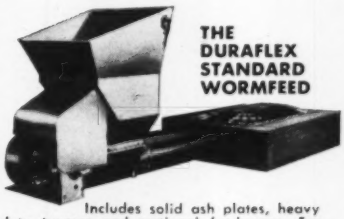
THE VULCAN RAMFEED

For use where steam demands vary rapidly and service conditions are severe. For loads up to 800 H. P.



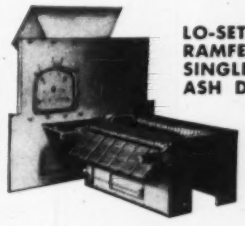
THE LO-SET RAMFEED

Requires less headroom, saves space and often costly pitting. For loads up to 350 H. P.



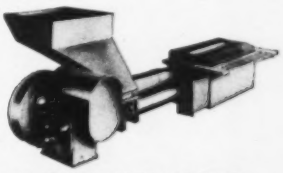
THE DURAFLEX STANDARD WORMFEED

Includes solid ash plates, heavy duty tuyeres and sectional feedworm. For loads up to 275 H. P.



LO-SET RAMFEED SINGLE ASH DUMP

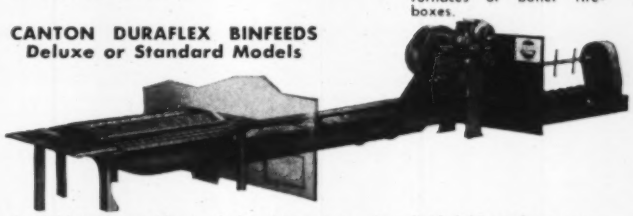
For special or very narrow furnaces or boiler fireboxes.



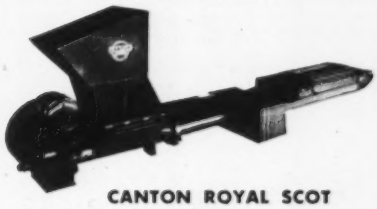
CANTON KILN STOKER

For ceramic kiln firing.

CANTON DURAFLEX BINFEEDS
Deluxe or Standard Models



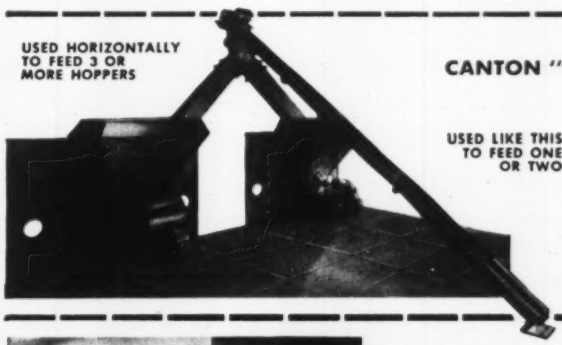
Available with or without ash dumping grates; unit or divided drives; front, rear or side boiler entry; ash sprays and furnace fronts. For loads up to 275 H. P.



CANTON ROYAL SCOT

A unit type wormfeed stoker for automatically, efficiently firing Scotch Marine boilers.

USED HORIZONTALLY TO FEED 3 OR MORE HOPPERS

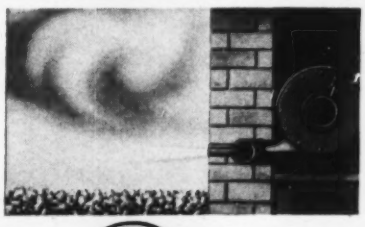


USED LIKE THIS TO FEED ONE OR TWO

CANTON "FLO-TUBE" HEAVY DUTY CONVEYORS

Screw type conveyors deliver coal from bin or pile automatically . . . free men for more exacting duties. "Off-on" switches will maintain desired levels in hoppers. Capacities to 10,000 lbs. per hour. Also widely used for conveying other materials such as steel chips, grain, pellets, wood waste, sand, etc.

COAL ENTERS EXPOSED END



CANTON "TURBO-AIRE" SYSTEMS FOR SMOKE CONTROL

Effects complete combustion. Simply "burns the smoke where the smoke begins." For boilers to 1000 H. P.

CANTON "SYNCHRO" COMBUSTION CONTROLS
Automatically adjusts fuel feed, air supply, boiler draft and combustion rates in proportion to steam demand or water and weather temperatures. Applicable to other forms of proportioning control.

CANTON STOKERS

CANTON STOKER CORPORATION

2400 ANDREW PLACE S. W. • CANTON, OHIO • PHONE 3-9133

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UTAH
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35831
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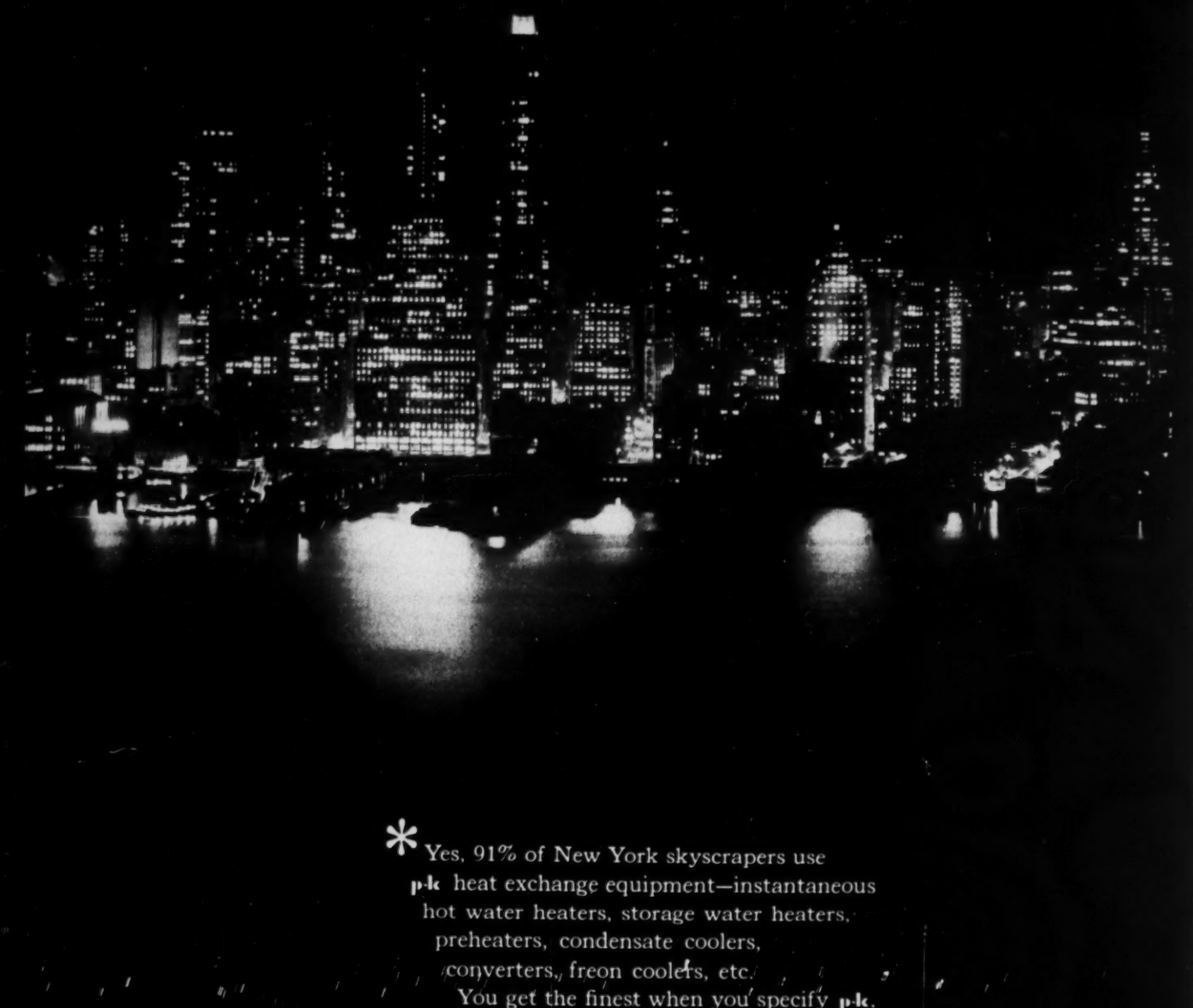
SEATTLE
Elliott 6360
SPOKANE
Main 5514
WISCONSIN
MILWAUKEE
Marquette 85528
WEST VIRGINIA
CHARLESTON
25321

91% are p-k equipped*

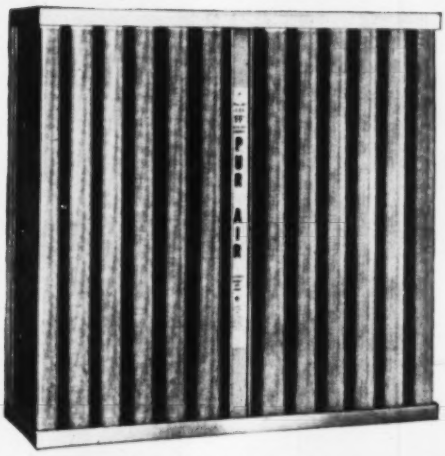


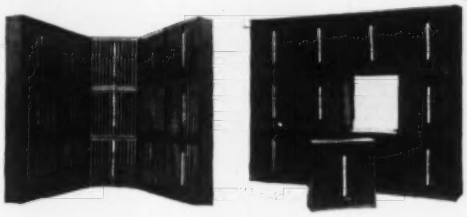
*Yes, 91% of New York skyscrapers use p-k heat exchange equipment—instantaneous hot water heaters, storage water heaters, preheaters, condensate coolers, converters, freon coolers, etc. You get the finest when you specify p-k.

the **Patterson-Kelley Co., inc.**

East Stroudsburg, Penn.

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities





to Remove odors

you need

Pur Air

ACTIVATED
COCONUT-SHELL CARBON

- ★ **Adaptable to any duct system**
- ★ **Easy to install**
- ★ **Over 11 lbs. of carbon to the square foot of surface area**
- ★ **World's most complete line**

Pur Air "FF" Filter-Fold units, as illustrated, may be used singly or in any combination to fit the duct system you are planning. Accordian-like construction provides maximum adsorbing surface. Filter-Fold units can be used in a great variety of combinations . . . single-plane assemblies, space-saving V-assemblies or a combination of both types.

Pur Air ACSC* is the only *proved* method of actual odor removal. The principle is simple . . . contaminated air passes through activated, coconut-shell carbon and leaves all odors behind. How long units will operate effectively is determined directly by the amount of carbon used. A third more of a quality carbon will remove odors a third longer before reactivation.

A continuous 33-year test on the adsorptive qualities of 15,000 different materials proved activated, coconut-shell carbon best for extreme retentivity to gas and odor adsorption. Coconut-shell carbon provides thousands of surfaces to draw in and retain foul odors, gases and impurities from the air . . . all these surfaces are contained in the myriad of tiny tunnels which fill each Pur Air ACSC* grain.

Pur Air "FF" Filter-Fold ACSC* Assembly is easy to install in small or large ducts. You will find all odor removal problems solved quickly and completely the Pur Air way.

* ACSC: *activated, coconut-shell carbon*

Pur Air DIVISION

BARNEBEY-CHENEY *Company*

(Successor to American Solvent Recovery Corp.)

COLUMBUS 19, OHIO

ADSORBITE DIVISION: producers of activated carbon

SOLVENT RECOVERY DIVISION: designers and builders of solvent recovery systems

Pur Air Division Barnebey-Cheney Company
Columbus 19, Ohio

Tell me more about odor-removing carbon . . .

- ☐ Capacity data on duct units
- ☐ Capacity data on package units
- ☐ Name of local representatives

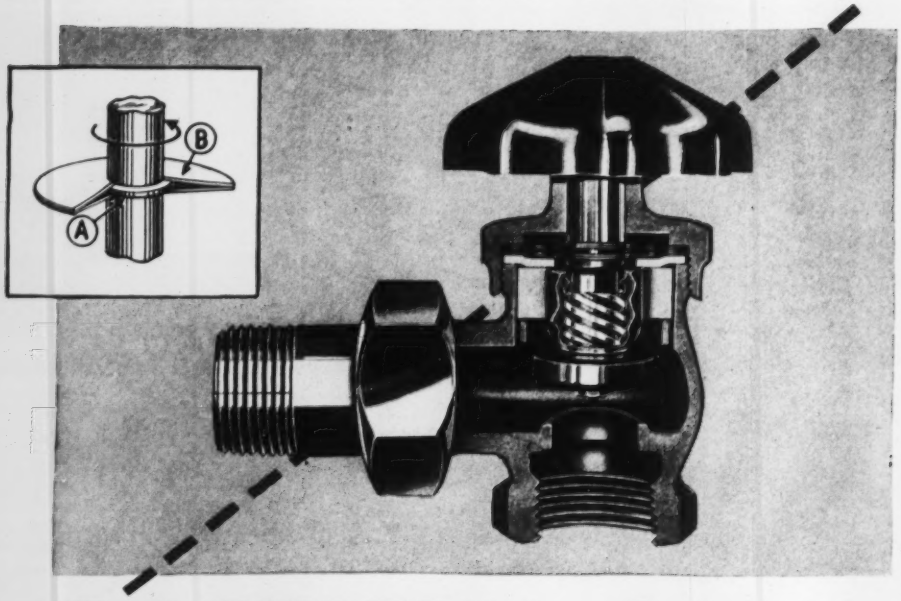
NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

A Valve that is



PACKLESS in fact

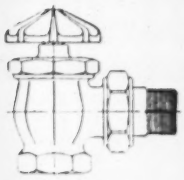
. . . not just packless in name

When the job calls for the kind of valve that will stand up across the years —when it calls for a valve that is packless in the full meaning of the word— then, no matter how far you look, you'll find in the Marsh Packless the only valve that completely fills the bill.

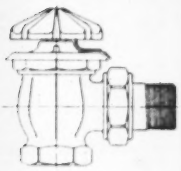
In fact, many users consider this the only valve that is packless in fact as well as in name, and they have a good reason for this. There is a difference between pack less and packless! The diagram tells the story of Marsh truly packless construction. A collar (A) is machined on the valve stem. The stainless spring steel wafers (B) press against this collar to form a tight annular seal This, you see, is a metal-to-metal seal—*permanently* leakproof.

And this better construction is typical of the quality and refinement found throughout the Marsh Packless Valve—in the swivel, self-seating, self-cleaning disc—in the excellent proportioning, machining, workmanship and finish.

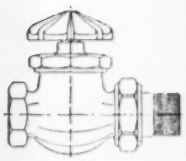
Packed valves can and do "blow out", scalding or burning the operator. This danger is avoided when you use the Marsh Packless. It is a valve you can rely on for any service up to 100 lbs. Furnished in a wide range of patterns including graduated and extended stem types, the Marsh Packless Valve is widely used for steam and hot water heating systems, coffee urns, steam kettles, sterilizers, ovens and similar services. Ask our representative or engineering department for facts.



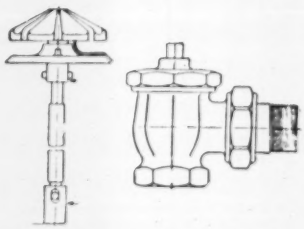
Wheel Angle



Wheel Angle Graduated



Globe



Extension stem

MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*

Dept. T, Skokie, Ill.

MANUFACTURERS OF GAUGES • THERMOMETERS • WATER REGULATING VALVES • SOLENOID VALVES

MARSH SINCE 1865

Quality Heating Specialties

LADISH

Controlled Quality

PIPE FITTINGS

reduce piping assembly time

Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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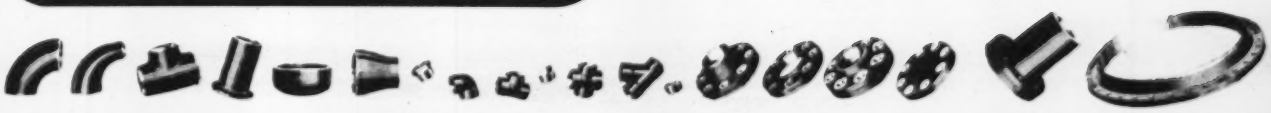
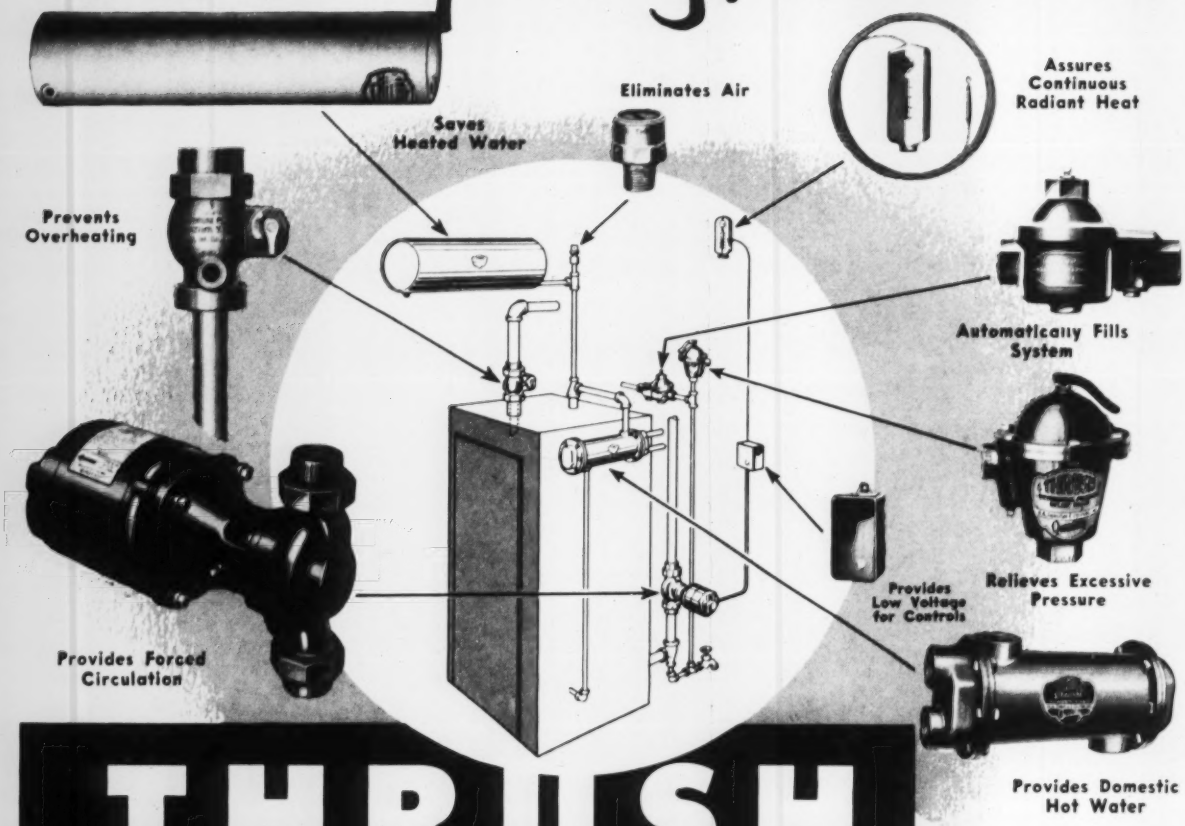


Sell Completely Automatic



THRUSH

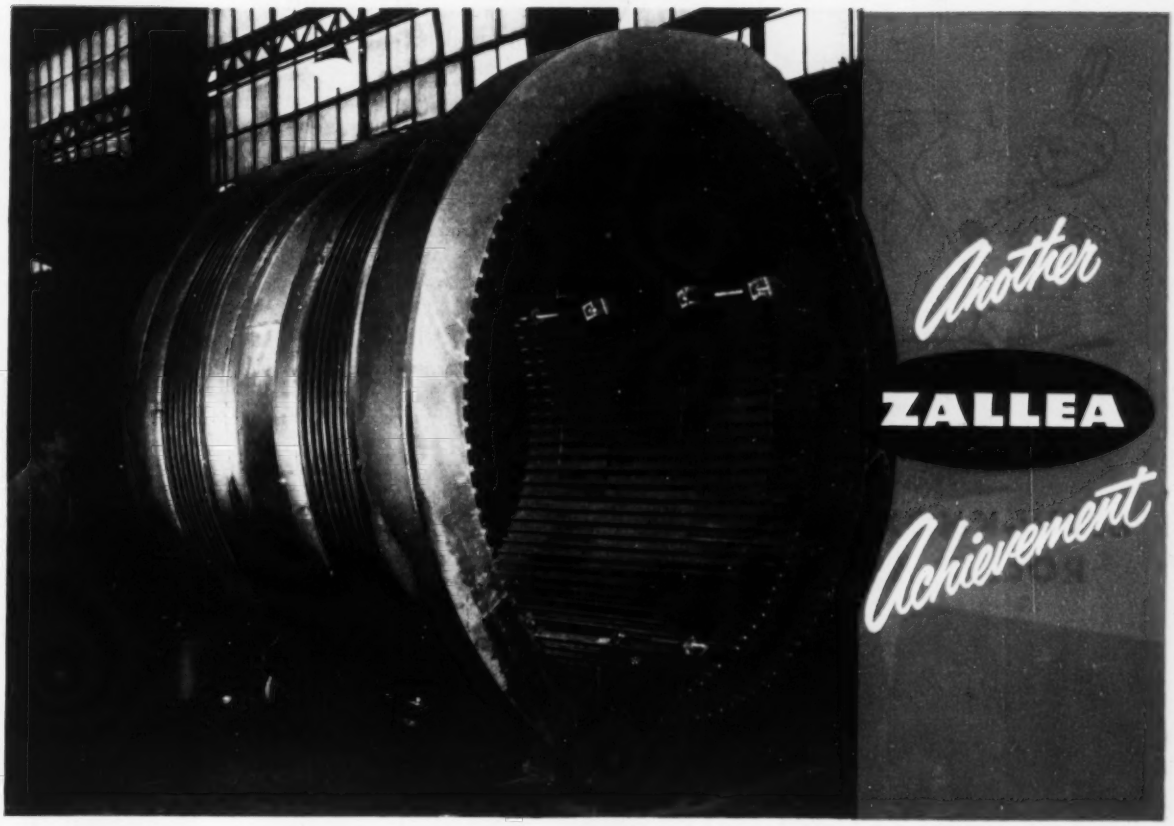
flow control HOT WATER HEATING

SUCCESSFUL DEALERS, who install Thrush Flow Control Systems on all their hot water heating jobs, tell us that every Thrush installation sells another one. Enthusiastic home owners tell their friends . . . build good will . . . and that means more sales and profit for you.

Thrush Flow Control System has everything to make sales easier and satisfy customers . . . unlimited choice of heating units (baseboards, radiant panels, convectors, etc.,) . . . fuel economy . . . small piping . . . comfort (less than 1° room temperature variation) . . . plenty of domestic water from the one boiler and years of trouble-free service. Sell the best heating equipment — SELL THRUSH. See your wholesaler for free Sales Helps and Free Engineering Service or write Dept. E-4 today!

H. A.
THRUSH
& COMPANY
PERU,
INDIANA

Assures a Continuous Flow of Radiant Heat



In the almost quarter century that we have been in business, we have been called upon to develop and produce many highly specialized types of expansion joints. None, however, have been more spectacular than the 109-inch joints recently developed for use in testing equipment for aircraft engine prototypes. These low pressure joints were designed with a hundred internal tie bars, which permit the joints to absorb the lateral deflection between a long exhaust header, operating at 650° F. and a series of large gas coolers, without the need for heavy anchors. Eight of these joints are now in service in a classified defense project.

This is just another example of how Zallea engineers, with the experience gained from specializing in one product—expansion joints, are able to successfully and economically solve the most difficult problems confronting this type of industry.

But this is not all—we regularly manufacture a complete line of expansion joints capable of service in virtually any type of expansion application. These joints are available in diameters from 3 inches to 30 feet for temperatures from sub-zero to 1600° F. . . . for pressures from vacuum to 300 psi in standard designs and up to 2,000 psi in special designs.

For full details regarding your expansion joint problems or requirements, just get in touch with us. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

For detailed information on Zallea Expansion Joints and services write today for a free copy of Bulletin 351.

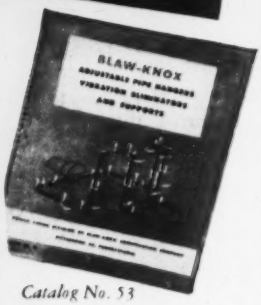
Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

All Movements Under Control with

BLAW-KNOX OVERHEAD ROLLER ASSEMBLIES

Type 9 Functional Assembly (illustrated) provides free rolling action in two directions and freedom of movement in three—lateral, vertical and horizontal. Its *internal swivel* action gives full control over all movements, and minimizes absorption of piping thrusts by the connecting flanges . . . a big help in keeping maintenance and replacement costs at rock bottom. Available for all standard size piping. Accommodates operating loads up to 12,000 lbs.



Catalog No. 53 on request.

POWER PIPING AND SPRINKLER DIVISION
BLAW-KNOX COMPANY
PITTSBURGH 33, PA.

BLAW-KNOX

[*Continued from page* 194]

Heated Roof Drain

HPAC 17—Steam jacketed roof drain to prevent back-up of water due to frozen water in drain inlet. . . . Steam chamber encircles sump area providing radiation from inner surfaces of entire sump. Live steam at 15 psig enters through steam inlet, travels through chamber around sump and is vented by outlet on opposite side. The drain, which is connected to building steam lines, is designed to carry off sudden heavy surges of water. Dome has wide flair, mushroom type strainer and a gravel guard. [Manufacturer: J. A. Zurn Mfg. Co., 1801 Pittsburgh Ave., Erie, Pa.]

Roof Drain

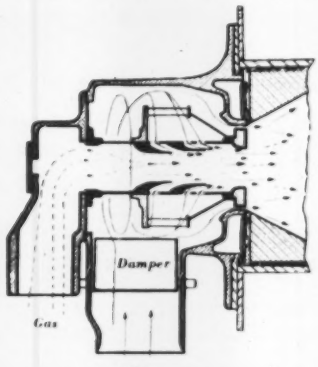
Centering Head

Centering Head for Pipes

HPAC 18**—Pocket-size centering head to lay out keyways, manifolds, bell-ends, butt-ins, uniform pipe bends and set tanks. . . . According to the manufacturer, the "Boyce" centered head with a dial set leveling gage can be used to mark a point at any degree from center on pipe or other round objects, to measure or establish the degree of any angle or of the bend on the outside or inside of any circumference, or measure the degree of declivity of any flat surface. The protractor dial is graduated in 2½ deg. [Manufacturer: Contour Marker Corp., 1843 Compton Blvd., Compton, Calif.]

Gas Burner

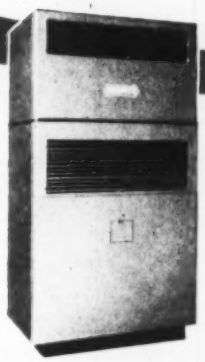
HPAC 19—"Voriflow" gas burner of pre-mix design for gas-firing boilers. . . . Gas flows through the central gas nozzle from the gas plenum. Simultaneously, combustion air from the blower enters the air plenum tangentially,



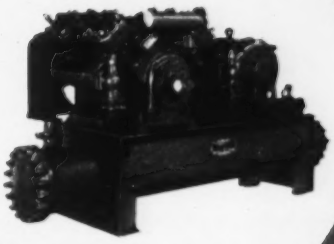
automatically controlled by the motor operated damper. Primary pre-mixing air is captured by a stationary air wheel register. This assembly directs the pre-mixing air through holes into the gas nozzle against venturi-shaped

DESIGNED for more AIR CONDITIONING profits for you

In this air conditioning business, your *profits* (and ours, too) depend upon *performance!* That's why every performance factor — efficiency, economy, long service life, etc. — is so carefully considered in the design of Brunner air conditioning equipment. You can always depend upon Brunner units to protect *your* profits — no other equipment is easier to install, maintain and service on the job.



Brunner service-proven Self-Contained Air Conditioners in 3 models in 5 sizes (2, 3, 5, 7½ and 10 H.P.) now available. Easy to install . . . needs only water and electrical connections.



The most complete line of "open type" Condensing Units in the world — from ⅛ H.P. to 75 H.P. Brunner CAN MEET your requirement.

Brunner Application Engineers' advice and data are available on all Brunner Products. This helpful, free service can save you many hours of valuable time in estimating and quoting on complicated installations. If you're planning air conditioning and refrigeration installations it will pay you to investigate Brunner. See your Brunner distributor, or write:

Brunner Manufacturing Company
Dept. L-43, Utica, N.Y., U. S. A.

IN CANADA: Brunner Corporation (Canada) Limited, Toronto, Ontario

YOU'LL ALWAYS BE GLAD YOU INSTALLED A BRUNNER SINCE 1906

higher efficiency

FROM SMALLER PUMPS!

I-R Motorpumps deliver more liquid per horsepower!

DOUBLE BALANCED IMPELLER—Balanced hydraulically to reduce thrust load; balanced mechanically to minimize vibration. This permits closer tolerances with less wear, and closer tolerances mean higher efficiency.

COMPACT—Pump and motor built as one unit on a single shaft. Motor is protected from liquid by a mechanical seal and a flinger.

ADVANCED DESIGN—Stuffing box is equipped with a heavy-duty, tamper-proof mechanical seal . . . contoured volutes and expert machining result in higher efficiency. The suction piece leads liquid directly to the impeller eye.

OVERSIZE SHAFT minimizes deflection and vibration—insures a smooth running impeller—increases life of mechanical seal.

OVERSIZE BEARINGS give larger radial and thrust capacity.

AVAILABLE FOR RUSH DELIVERY—Call the nearest Ingersoll-Rand branch office and join the group of leading air conditioning contractors who are currently using these long-life, trouble-free pumps.

Compact, advance designed Ingersoll-Rand Motorpumps give you . . .

- **LOW FIRST COST**
- **LOW POWER CONSUMPTION**
- **SPACE SAVING**
- **HIGHER EFFICIENCY**
- **EASY INSTALLATION**

For complete details, write for Bulletin 7177.

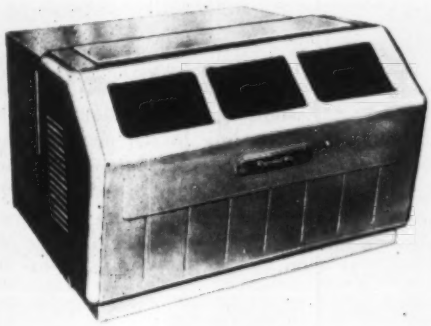
Ingersoll-Rand
11 Broadway, New York 4, N. Y.

891-9

air baffles. The air and gas are thoroughly mixed enroute through the gas nozzle. The outer secondary air ring controls the amount of secondary combustion air admitted to the combustion chamber. Ignition takes place at this point. [Manufacturer: Orr & Sembower, Inc., Morgantown Rd., Reading, Pa.]

Room Air Conditioner

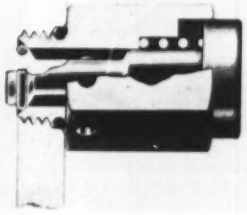
HPAC 20**—Air conditioner designed especially for homes and offices. . . . The company is entering the air conditioning field with this new unit to be marketed under the trade name of "Rapidayton." One-half and ¾-ton models are available. The ¾-hp model is said to be capable of controlling temperatures in an area of up to



485 sq ft. It extends into the room 13½ in. Controls are recessed inside the top door of the cabinet. [Manufacturer: The Dayton Pump & Mfg. Co., 500 N. Webster St., Dayton 1.]

Release Valve for Air Pressure Systems

HPAC 21—Manually operated release valve designed to allow rapid escape of air pressure systems, bleeding of air out of fluid systems, etc. . . . Comprised of four working parts, it employs the "O" ring sealing principle. The valve is normally held closed by a spring when the



manual pressure is released. It is designed to provide quick operation, at the same time eliminating the hazards involved where pet-cock types of valves would be employed and possibly not turned off. [Manufacturer: James-Pond-Clark, 2181 E. Foothill Blvd., Pasadena 8, Calif.]

Valves Made of Polyethylene

HPAC 22—One and two-in. bore valves made of polyethylene. . . . Light in weight, they are said to resist hydrofluoric, sulfuric, nitric and hydrochloric acids at temperatures up to 160 F. The valves are furnished with standard drilled flanges for easy incorporation into existing installations. [Manufacturer: American Agile Corp., P.O. Box 168, Bedford, Ohio.]

Cool and Gentle as a Mountain Breeze...

the Mueller Climatrol 904 Summer Air Conditioner

...ideal for radiator-heated homes

Mueller Climatrol solves the problem of how to cool radiator or radiant-heated homes with the new Mueller Climatrol 904. A self-contained cooling unit complete with blower — the 904 has provisions for duct connections that make it ideal for radiator or radiant-heated home cooling applications. It is also available with return and discharge grilles as shown. Trim, compact, highly efficient — there's a size to handle most of your customers' needs — 2, 3, 5, 7½ tons.

Commercial Units, too

This same unit hits the nail on the head for commercial use in small groceries, barber shops, drug stores, apparel shops, florists, restaurants, etc. Finished in handsome gunmetal gray—the 904 adds beauty to interiors wherever it is installed.

Built to Mueller's 96-year standard of high quality —the 904 gives you the dependable service that means greater customer satisfaction. Be sure to investigate the 904 — it's the latest product from the Big Name in Heating *and Cooling*.

L. J. MUELLER FURNACE CO.

2023D W. Oklahoma Avenue • Milwaukee 15, Wisconsin

96th Anniversary

Mueller Climatrol

D-139

This is only one of many new items in the 1953 Mueller Line. Write for the latest information on the new Mueller Climatrol 904 Self-Contained Cooling Unit.

WE HEAR THAT . . .

By vote of the stockholders, the name Midwest Piping and Supply Co., Inc., has been changed to *MIDWEST PIPING CO., INC.* According to *A. G. STOUGHTON*, president and chairman of the board of directors, there has been no change in ownership, management, personnel or activities of the company, nor are any such changes contemplated. The name change was made to indicate that the company has grown away from the supply business. Its main activity is the fabrication and installation of piping and the manufacture of welding fittings.

A new educational, color movie, "The Story of Automatic Refrigeration Controls," has been produced by the *ALCO VALVE CO.* It takes up many phases of the service job of refrigeration and air conditioning engineers. In addition, examples are shown of how to choose the right valve, how to install valves and how the various types of valves operate. Also shown are schematic drawings of refrigeration systems in action. Further information on the film is available from the firm at 865 Kingsland Ave., St. Louis 5, Mo.

E. A. NORMAN, JR., president of *NORMAN PRODUCTS CO.* of Columbus, Ohio, has announced that his firm has purchased all production machinery and tools of the Security Mfg. Co. of Kansas City, Mo. All tools, dies, patterns, designs, and the trade name, "Inn-A-Wal," are involved in the purchase. According to Mr. Norman, the move is designed to round out his firm's existing production program for the manufacture of gas-fired heating units and air conditioning equipment.

The *CLIFFORD MFG. CO.*, manufacturers of metallic bellows, has designed a special slide rule and table of bellows characteristics to provide a quick method of selecting the right bellows for a particular application. The slide rule handles three variables: life expectancy, pressure and maximum stroke. When used in conjunction with the table, it is possible to calculate bellows life, permissible pressures and permissible stroke. The slide rule, table and a set of bellows templates sell for $1.00. Further information is available from Fred Hottenroth, Sales Manager, Clifford Mfg. Co., 123 Grove St., Waltham, Mass.

A 25-minute, sound motion picture has been made by the *H. OWENS CO.* showing the operation of its new jet pattern developer. According to the manufacturer, any mechanic can lay out sheet metal patterns by attaching the templates, adjusting for pitch or offset and rolling out the complete pattern. Information on the 16 mm film, or booklets on the jet pattern developer, may be obtained from the firm at 9300 Venice Blvd., Culver City, Calif.

A new plant extension by the *FOXBORO CO., LTD.*, at Montreal has more than doubled its instrument manufacturing facilities in Canada. Matching the original building, it adds 23,000 sq ft of factory space for the production of instrument parts, assembly of instrument panels

ELECTRO
Extra
DYNAMIC
Dependable industrial motors

E.D. motors are engineered for *silent* operation with special slot design, dynamic balancing and scientific bearing assembly.

FOR QUIETER OPERATION . . . Over half a century of building motors for "the silent service" to power and air-condition U. S. submarines has given Electro Dynamic an unequalled experience in producing motors for installations where SILENCE is a primary consideration.

WRITE TODAY FOR CATALOGUE NO. 481.

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY

T F

Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

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TAYLOR FORGE & PIPE WORKS
General Offices & Works • Chicago 90 • P. O. Box 485
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

More and More Leading Engineers are Now Recommending

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UNION ASBESTOS & RUBBER COMPANY

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Supply and Service, Inc.
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In the eight-county area surrounding Philadelphia, Supply and Service, Inc. is ready to serve insulation users from their complete line of Unarco materials.

Unibestos, Amocel, and other famous Unarco Insulations are always carried in stock for immediate delivery from their centrally located warehouse. Promptness and Quality long have been the Supply and Service "trade mark."

For competent engineering assistance, courteous cooperation, and reliable estimates—throughout the fast-growing Delaware Valley Industrial Area—write, or phone RIttenhouse 6-0210, for recommendations and from-stock deliveries.

INDUSTRIAL Insulations

PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

and cabinets, storage of materials and for enlargement of the plating, finishing and shipping departments. An additional 5000 sq ft on a lower level provides a cafeteria for employees and training school facilities.

A father and son team, *CARL J. BUSH* and his son *BILL BUSH*, have been awarded the "Thermobloc" sales plaque for turning in the top sales record among 38 national distributors. They own the *CARL J. BUSH CO.* in Detroit. "Thermobloc" space heaters are manufactured by Prat-Daniel Corp.

Development of a new major market for large molded plastics parts has been announced by *JOHN L. McMURPHY*, general manager of the *GENERAL ELECTRIC CO.'s* plastics department. He predicts that all important makes of window air conditioners will be housed in one-piece plastic cabinets by mid-1955. According to Mr. McMurphy, in two years the plastics industry will be producing air conditioning cabinets at an annual rate exceeding 450,000. General Electric estimates industry-wide sales of 700,000 window air conditioners in 1955, more than double the 325,000 units sold in 1952.

WALTER L. FLEISHER, president of *AIR & REFRIGERATION CORP.*, has announced the moving of the sales, engineering and general offices to 139 Madison Ave., New York 22.

At a meeting of the directors of *BUILDERS IRON FOUNDRY*, *EARL H. BRADLEY* was elected president to succeed Henry S. Chafee. Mr. Chafee will remain as treasurer of the company. At a later meeting of the directors, *GEORGE W. KELSEY* was elected president of *BUILDERS-PROVIDENCE, INC. BPI* is the instrument division of Builders Iron Foundry.

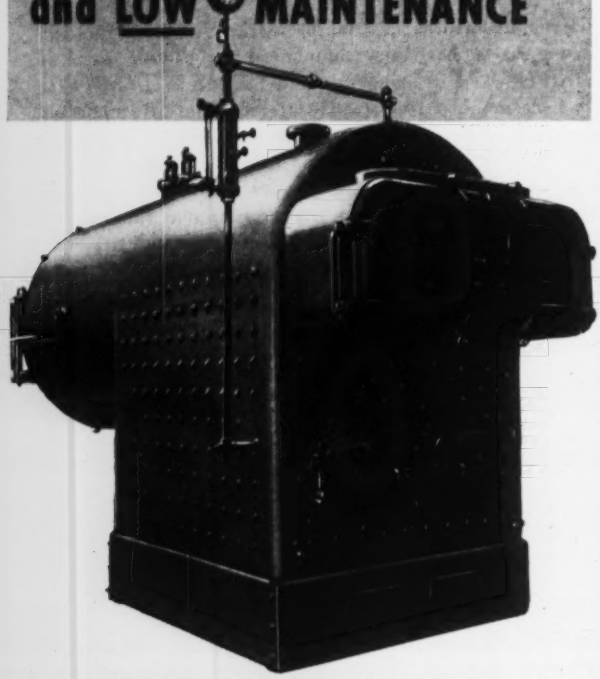
Plans for the construction of the first rolling mill on the Pacific coast for the production of aluminum sheets, strips and circular shapes have been announced by the *HARVEY MACHINE CO., INC.*, of Torrance, Calif. Erection of a new plant, which will cost approximately $20 million, will begin as soon as a site is selected.

In order to provide industry with better engineering, production and research services in the fields of filtration and porous media, three organizations have affiliated as the *PALL FILTRATION COMPANIES*, under the leadership of *DR. DAVID B. PALL*, a pioneer in the development of porous metals, alloys and plastics in sheet and fabricated forms. Members of the new research group are Micro Metallic Corp., Aircraft Porous Media, Inc., and the Porous Plastic Filter Co. The organization is located at Glen Cove, N.Y.

GOLDEN-ANDERSON VALVE SPECIALTY CO. of Pittsburgh, has acquired the shop and equipment of Imperial Machine Works, Inc.

WESTINGHOUSE ELECTRIC CORP. in Pittsburgh has announced plans for a multi-million dollar plant to produce

All-Welded
for HIGH EFFICIENCY
and LOW MAINTENANCE



TITUSVILLE
"WP" TYPE
FIREBOX BOILERS

Write today for Bulletin B-3030

Precision die formed, fusion-welded into a single-piece unit, the sturdy Titusville "WP" Boiler is designed in every detail to deliver long-lived, satisfactory heating and power service for exacting industrial and institutional requirements. ● Investigate the advantages for your application!

THE TITUSVILLE IRON WORKS COMPANY
A division of Struthers Wells
Representatives in Principal Cities
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atomic equipment. The plant will be operated by the newly formed Atomic Equipment Dept. in the Atomic Power Div. The new facility, believed to be the first major private enterprise of its kind anywhere, will be located in Harmar Township, near Pittsburgh. At this plant the company will engineer, manufacture and sell products that have been developed for atomic power plants.

Dealers for *LANCASTER PUMP & MFG. CO., INC.*, will stage a special sales promotion during May which is National Water Systems Month. For that occasion, the company has developed a new line of pumps and water systems which was introduced to its sales engineers at a series of meetings held recently.

Engineering considerations for refrigeration equipment using "Freon-22" are explained in a new lecture display prepared by the *E. I. DU PONT DE NEMOURS & CO.* for use before refrigeration engineers' groups. The display points out special chemical and physical properties of the refrigerant which affect design of lower temperature or higher capacity equipment. A modified version of the engineering display will be made available next fall to refrigeration servicemen's groups.

AIR EQUIPMENT DISTRIBUTORS, INC., wholesale distributor for Servel air conditioning equipment, has announced the opening of a showroom in New York to exhibit residential, commercial and industrial air conditioning equipment to both dealers and the public. The showroom, at 624 Second Ave., is open daily from 2 to 5 p.m.

INTERNATIONAL GLASS CORP., of Los Angeles, has recently purchased all the plant facilities and equipment of the Perrault Glass Fiber Corp. in Newport, Ark. The plant produces glass fiber and glass fiber pipe wrap, outer wrapping for pipe, roofing material, battery retainers, battery separators and irrigation canal liners. Full production will be resumed as soon as engineering improvements are finished to produce a more complete line of products.

JOHN DOLIO, of the Chicago architectural firm Shaw, Metz and Dolio, was the winner of a contest sponsored by the *MITCHELL MFG. CO.* at the 11th International Heating and Ventilating Show. A 1953 ¾ horsepower window-type unit was awarded for estimating the number of turns made during the show by a large replica of the company's one-knob "Weath'r Dial" air conditioner. Mr. Dolio's estimate was 1943 turns.

RHEEM MFG. CO. has leased the entire 22nd floor of the new 23-story, air-conditioned office building now being built at 477 Madison Ave., in New York. Excavation work for the building has been completed and occupancy is expected in the latter part of this year.

The stockholders of the Independent Pneumatic Tool Co. have voted to change the name of the firm to *THOR POWER TOOL CO.* According to *NEIL C. HURLEY, JR.*, president, the business has so changed in the past years that the name of the company is no longer descrip-

tive of its operations. The trade name, "Thor", has been used as identification of all of the firm's power tools since 1893.

MINNEAPOLIS-HONEYWELL REGULATOR CO. has been named one of America's best managed companies by the American Institute of Management and has been presented the institute's Certificate of Management Excellence for 1952. Only 330 companies throughout American industry received this recognition.

WARD LEONARD ELECTRIC CO. of Mount Vernon, N. Y., has announced a new location for its Chicago office at 3100 N. Cicero Ave., Chicago 41. *KLINE GRAY* is manager of the office.

PEERLESS PUMP DIV. of the Food Machinery and Chemical Corp., recently held a meeting in Indianapolis for all sales personnel and some administrative and engineering personnel. Led by *B. A. TUCKER*, division sales manager, the five-day meeting included discussions of products and sales strategy in addition to product clinics and demonstrations of Peerless' principal product lines.

For the third straight year the *YOUNGSTOWN SHEET AND TUBE CO.* has been awarded a George Washington Honor Medal by Freedoms Foundation of Valley Forge, Pa., for its employee publication "The Bulletin." The company also has announced the addition of its new No. 3 blast furnace at the Indiana Harbor works. The furnace, with a hearth diameter of 28 ft and a rated capacity of 1500 tons daily, is the third major unit to go into production since the Indiana Harbor expansion program was begun in 1950.

A feature of the national convention of "Z-Crete" licensed applicators for the *ZONOLITE CO.* was an "Oscar" award to the applicator judged to have made the greatest contribution to the "Z-Crete" industry. The award, given early this month during the convention, was an all-expense trip to Hawaii.

A silver trophy for top sales performance in 1952 was presented recently to *JOHN S. KING*, manager of the Cincinnati branch of *FAIRBANKS, MORSE & CO.* The Colonel Robert H. Morse cup was presented by *COLONEL MORSE* at a dinner in Cincinnati held in honor of the occasion.

REMINGTON CORP. has announced the election of *CALEB CANDEE BROWN, JR.* as treasurer, *FRANCIS P. REAGAN* as comptroller and *CHARLES E. DOWNEY* as assistant treasurer. Mr. Brown succeeds Kenneth E. Latimer, who has retired, while the other two posts are new ones.

The Correctair Div. of *BOYLE-MIDWAY, INC.* now is the *AIREACTOR CORP. ROY CHANDLER*, formerly director of the Correctair Div., has been named president of the new corporation.

2 New Exclusive BUILT-IN Safety features

CFE DRAFT CONTROLS

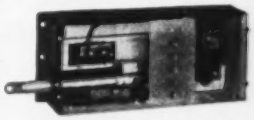
Closed and open view of CFE Damper Control.

• CLEVELAND *Sequence* DRAFT CONTROLS are providing dependable automatic, remote control of draft for thousands of industrial, commercial and institutional boilers. Their basic principle has been tried and proven —on most installations they pay for themselves out of fuel savings in less than one year.

Two important new CFE safety features are now offered as optional equipment *built into the control.* The first of these has up to now been partially obtainable only by installing separate remote equipment at higher cost. The second is a brand new device providing convenience and safety factors never before available.

1 **LOW-DRAFT CUT-OFF** This *Integral Minimum Draft Switch* shuts down firing on oil or gas boilers when draft falls below a predetermined unsafe limit. Instant and nuisance shutdowns due to momentary puffs are prevented by a time-delay relay. A signal light indicates momentary or sustained draft below the required minimum.

2 **STARTING DRAFT SELECTOR** This *Adjustable Start* feature provides a partial opening of the damper to assure the predetermined optimum draft for smooth, safe ignition—permitting purging of the boiler without an excessive draft condition that might pull pilot flame away or cause burner shut-down. When ignition is completed, damper control goes into the full range of automatic draft regulation. Recommended particularly for induced draft installations for oil or gas firing.



CFE Lectricarm Drive Unit with starting draft selector.

For complete information, use coupon

CLEVELAND FUEL EQUIPMENT CO. — COMBUSTION INSTRUMENTS & CONTROLS FOR EFFICIENCY AND ECONOMY

CLEVELAND FUEL EQUIPMENT COMPANY

1111 Brookpark Road, Cleveland, Ohio

Please send me information on:

☐ CFE Integral Minimum Draft Switch for low-draft cut-off.

☐ CFE Adjustable Start feature for starting draft selection.

Name ..... *Title* .....

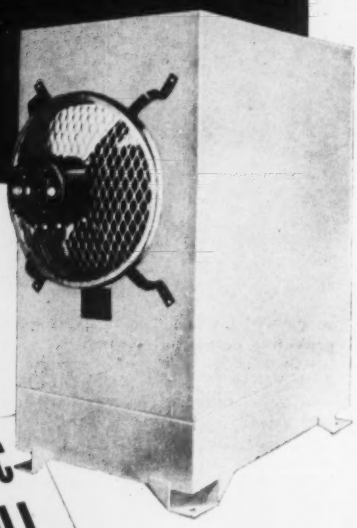
Company .....

Address .....

City ..... *State* .....

COOLING TOWER

by KRAMER



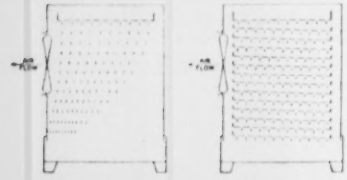
3 to 8 Ton

SCIENTIFIC— NEW FILL

MORE CAPACITY
The redistributing decks keep the water uniformly suspended, providing maximum contact between air and water.

LONG LIFE
Casing and sump are heavy gauge steel, hot dipped galvanized after fabrication. Redistributing decks are metal and fireproof.

EASY INSTALLATION
Unit is shipped assembled but can be knocked down to eliminate rigging costs. One fitting required for drain and over-flow.



Conventional Fill — Kramer Fill

Write for Catalog R-225

KRAMER TRENTON CO.
Trenton 5, N.J.

WHO'S WHAT

The *BUSH MFG. CO.* has announced the appointment of *THOMAS L. ARNOLD* as sales manager of the Heating Div. and *H. P. PETERSON* as chief engineer. In his new capacity, Mr. Arnold will supervise the setting up of a nationwide sales force to handle the firm's heating products. Past president of the Connecticut chapter of ASHVE, he had been general manager of the Vulcan Radiator Co.

The new chief engineer, Mr. Peterson, formerly was a consulting engineer and had represented the company in Philadelphia for many years.

WESLEY J. PEOPLES, chairman of the Institute of Boiler & Radiator Manufacturers and former president and chairman of the board of United States Radiator Corp., has been named president of the *UNITED STATES AIR CONDITIONING CORP.* Mr. Peoples succeeds Albert A. Feinberg, who died last October.

WILLIAM C. EGAN, district dealer manager at Cleveland, has been named assistant to the president of *CARRIER CORP.* Mr. Egan, who has been with the corporation since 1942, is being succeeded at Cleveland by *H. W. BRANSON*, formerly branch dealer manager in Cincinnati.

As part of the reorganization of its production and engineering departments, two executive changes have been announced by the *QUAKER OATS CO.* *KENNETH W. PIKE*, general operating manager, was named director of engineering and planning, a newly created position. His assistant, *JOHN D'ARCY*, succeeds him as general operating manager in charge of production. The reorganization changes the status of the engineering department. Formerly a sub-branch of the production department, engineering is now set up as a separate department of engineering and planning.

WILLIAM L. HOLLADAY and *RALPH M. WESTCOTT* have announced the partnership of *HOLLADAY & WESTCOTT, ENGINEERS.* The new firm, at 5384 Huntington Drive, Los Angeles 32, will specialize in the design of environmental test apparatus and low-temperature refrigeration.

ANDREW F. CASSIDY has been appointed general sales manager for *RHEEM MFG. CO.* Mr. Cassidy joined the company in 1945 and for the past four years has been sales manager of water heaters and boilers.

EMIL A. VIEROW has been named superintendent of the Youngstown district Fuel and Power Dept. by the *YOUNGSTOWN SHEET AND TUBE CO.* Prior to joining the firm in 1944 as superintendent of the fuel department, he was chief fuel engineer for the American Steel & Wire Co.

DR. R. C. ULMER, known in the power field as a feedwater specialist and for the last seven years technical director of E. F. Drew & Co., has joined the Engineering Dept. of *COMBUSTION ENGINEERING-SUPERHEATER, INC.* He will be engaged in development work.

The *FURNAS ELECTRIC CO.* has announced the appointment of *WALTER A. MEYER* as general manager in charge of sales and publicity. Mr. Meyer formerly was with Allis-Chalmers Co. in sales and distribution of products in the Apparatus Dept.

At its annual meeting in mid-February, the *REFRIGERATION AND AIR CONDITIONING CONTRACTORS ASSOCIATION OF CHICAGO* elected officers and directors for 1953. Those elected were: president, *JOHN ANNIS* of Lipman Refrigeration Sales; vice-president, *LEON EPSTEIN*, Reliable Refrigerating & Air Conditioning Corp.; secretary-treasurer, *WILLIAM L. WATSON*, Refrigeration Service Co. Elected as directors were: *FRANK L. HAAS*, Haskris Co.; *WILLIAM L. LONG*, Chicago Conditionaire Co.; *WALTER McCARTY*, McCarty Bros. Equipment Corp.; *EARL A. McLEAN*, Merchants Commercial Refrigeration Engineering Sales, Inc.; *HARVEY O. MILLER*, Murphy & Miller, Inc.; *A. W. THEIS*, Theis Refrigeration Co., and immediate past president, *HARRY L. BRANSKY*, Branksy Refrigeration Co.

Two new appointments announced by *SERVEL, INC.* are those of *THEODORE L. PANTZ* as vice president in charge of manufacturing and *JACK A. SCARLETT* as manager of manufacturing engineering, a newly created position. Mr. Pantz and Mr. Scarlett had been associated with the Seeger Refrigerator Co. in Evansville, Ind.

HARRY J. JESSEL now is vice president and director of sales of the *GUSTAVE A. LARSON CO.*, wholesalers of refrigeration, heating and air conditioning equipment in Wisconsin, Illinois and Iowa.

H. P. MUELLER, JR., and *F. J. NUNLIST, JR.*, have been named vice presidents of the *L. J. MUELLER FURNACE CO.* Mr. Mueller was formerly assistant sales manager and Mr. Nunlist was general sales manager. *H. D. WIRTH*, former controller, was named secretary of the company. A fourth appointment announced by the firm is that of *WILLIAM H. BRAND* as director of the board of directors.

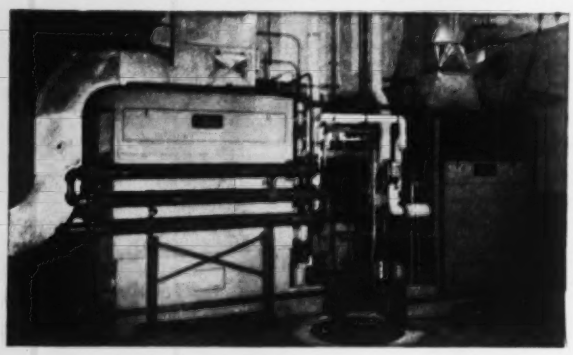
WILLIAM H. PHILLIPS has been appointed vice president in charge of production of the *HAPMAN-DUTTON CO.* in Kalamazoo. Mr. Phillips formerly was assistant to the president of Hein Werner Corp.

The *HEATING AND COOLING COIL MANUFACTURERS' ASSOC.* has elected the following officers for the ensuing year: *L. L. SIMMONS*, president; *HOWARD F. BRINEN*, vice president; and *WILLIAM P. RAFFONE*, secretary-treasurer. Mr. Simmons is with the American

Any engineer will tell you
Skidmore
offers more pump performance
There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.
TYPE UV
Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.
Write for Bulletin No. 19-A
TYPE HS
Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.
Write for Bulletin No. 14-A
TYPE TM
Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.
Write for Bulletin No. 17
TYPE CV
Type CV Vertical Pump is ideal where space is limited. This model like every Skidmore Pump is built to meet specific requirements. For the correct solution to your own pump problem consult a Skidmore Heating Pump Specialist.
Write for Bulletin No. 21
Sales representatives in principal cities
SKIDMORE CORP., ST. JOSEPH, MICHIGAN
Skidmore Pumps

This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

Blower Corp., Mr. Brinen is with the Young Radiator Co., and Mr. Raffone is with the G & O Mfg. Co. The association recently established headquarters in Detroit and is engaged in the development of test codes and engineering standards.

TACO HEATERS, INC., has announced the appointment of *ROBERT H. CHAFFEE* as sales manager, heating and cooling products. Mr. Chaffee has been with the firm since 1943 in the capacity of New England sales manager.

PANELLIT, INC. has announced the appointment of *J. C. FREYBERG* as advertising manager of the company and its two associated companies, Panalarm Products, Inc. and Panascan, Inc. For the past nine years, Mr. Freyberg has been associated with Wheelco Instruments Co. in sales, sales promotion and advertising positions.

DON B. RENTSCHLER and *EDWARD F. KOUNOVSKY* have been appointed to the sales and engineering departments of *SPORLAN VALVE* Co., St. Louis.

The *TRANE CO.* has announced several new additions to its staff. *RICHARD F. SCHIEWETZ* has been appointed plant manager of the eastern manufacturing division with offices in Scranton. Mr. Schiewetz formerly was superintendent of the air conditioning division of Servel, Inc. *WERNER G. WASSMANDORF* now is a member of the refrigeration sales department. His first assignments will be with the new Trane packaged water chiller and the hermetic compressor. The third new appointment is that of *GEORGE A. ELLIS* to the products engineering department where his work will be chiefly on control application engineering and control systems.

A. C. BROWN, JR., regional manager of the *AIR PRODUCTION SALES CO.*, has been appointed general sales manager. Mr. Brown, who had been manager of the central region in Pittsburgh, now will be at the New York office. *J. H. KEENEY*, administrative assistant in Pittsburgh, succeeds Mr. Brown as regional manager. *J. H. HART*, Detroit district manager, succeeds Mr. Keeney and *R. A. JAMIESON*, assistant sales manager in Detroit, succeeds Mr. Hart.

JAMES R. McCUTCHEON, JR., has been appointed sales manager of the Valve Div. of *HOMESTEAD VALVE MFG. CO.* For the past seven years he has served as district representative for American Car and Foundry Co.'s Valve Div. in western Pennsylvania, Ohio, Kentucky and West Virginia.

CRANE CO.'s Heating Div. has been expanded with the addition of three men to its general office staff. *CHARLES E. TOWNER* is assistant to the vice president, *EUGENE P. ALLEN*, manager of the Heating Dept., and *EDWIN B. COLE*, manager of the newly created Purchased Heating Dept. Mr. Towner formerly was supervising engineer in charge of the thermal laboratory at the firm's

Chicago works; Mr. Allen had been manager of the Heating Dept. at the Seattle branch and Mr. Cole had been a member of the sales staff in Miami and Jacksonville.

JOHN H. KILMER, JR., has been appointed chief engineer and *PAUL A. BRAUER*, assistant chief engineer in charge of production of *GOLDEN-ANDERSON VALVE SPECIALTY CO.* in Pittsburgh. Both men have been associated with the company since 1938.

LAWRENCE H. LEMKE has been appointed general superintendent of *D. J. MURRAY MFG. CO.* in Wausau, Wis. He formerly was superintendent of the machine shop. Mr. Lemke has been with the firm for 27 years starting as an apprentice in the machine shop.

WALTER A. NAUMER is the new president of *PYROFAX GAS CO.*, a division of Union Carbide and Carbon Corp. Mr. Naumer has been with the firm since 1926 and vice president since 1950.

BERNARD A. SEIPLE, well known gas industry executive, has been appointed manager of the newly created gas heating division of *YORK-SHIPLEY, INC.*, York, Pa., according to an announcement by *S. H. SHIPLEY*, president. Mr. Seiple most recently was vice president in charge of sales for the Jersey Central Power & Light Co., Asbury Park, N.J.

WILLIAM V. MAUER has joined *SCHNACKE, INC.* as sales manager. For more than 20 years he was president of the Mauer Electric Co. In his new position, Mr. Mauer will direct sales of the firm's compressors, condensing units and home air conditioners through 11 sales representatives throughout the country.

EDWARD V. SULLIVAN has been promoted to sales manager of the *LAU BLOWER CO.'s* Fan Div. *THOMAS H. MARTIN* was named manager of advertising and sales promotion, the post formerly held by Mr. Sullivan.

COMMONWEALTH EDISON CO. of Chicago has appointed *HOWARD L. GRAU* as assistant director of purchases and *ROBERT B. GEAR* as purchasing agent for mechanical equipment, supplies and construction.

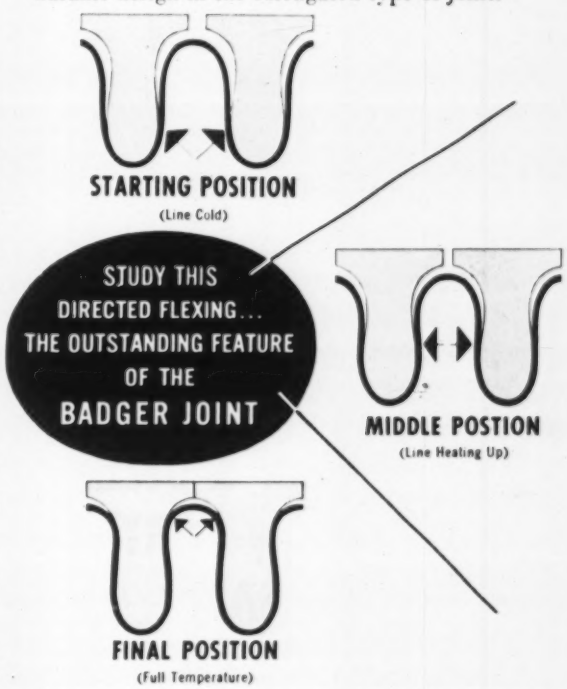
The *PYLE-NATIONAL CO.* of Chicago has announced the appointment of *E. H. REED* as assistant sales manager and *JOHN DEVOL* as district manager for the Chicago territory. Mr. Reed joined the company in 1925 as a design engineer and most recently was manager of the special products division. Mr. Devol, who has been with the company since 1945, has been with the sales department.

Appointment of *R. L. FORSBERG* as expense and systems director of the Airtemp Div. of *CHRYSLER CORP.* has been announced. He has been budget director of the division since 1948.

directed *Flexing*

...distributes flexing stresses
...multiplies expansion joint life

ON THAT pipe line you are installing, you will want to avoid expansion joint maintenance... which means, of course, you will want the packless, corrugated type of expansion joint. And you will want the best functioning, most durable design in the corrugated type of joint.



Note how the corrugation, when hit by the expanding pipeline, wraps itself around the surface of the matching equalizing rings which 'direct' the flexing. Stresses are distributed evenly over all areas of the all-curve corrugations, in contrast with straight-sided corrugations which when flexing move forward and backward as in a plane, concentrating stresses at the top and bottom of each corrugation.

It's this engineering thinking upon which the design of the Badger Expansion Joint is based that is your assurance of buying the best when you buy Badger.

BADGER MANUFACTURING COMPANY
Original and Sole Manufacturer of Badger Expansion Joints
230 BENT STREET • CAMBRIDGE • MASS.

Cut all installation holes faster

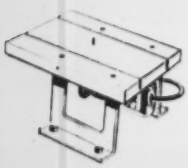
ONLY $49.50 Complete with 5 different blades

Makes short work of cutting openings in ducts for registers.

with this NEW Black & Decker Utility PORTABLE JIG SAW

Perfect for cutting holes in floors and walls for running pipes.

Here's a new Black & Decker tool to help speed all your installation work—the B&D Utility Portable Jig Saw! It's perfect for cutting holes in floors and walls to run pipes and ducts . . . it makes short work of cutting openings in ducts for registers! And it will make any cut — straight or irregular — in sheet metal and boards of all types! Needs no "entrance hole" when making pocket cuts in wood or wallboard—the sabre blade cuts its own! And the best part of all is that the price on this new tool, complete with 5 blades to cut most every material known, is considerably less than you expect for this quality. See and try the Black & Decker Utility Jig Saw today at your favorite Black & Decker outlet. For free catalog, write to: THE BLACK & DECKER MFG. CO., Dept. 640, Towson 4, Md.



Accessory Table converts Jig Saw to Bench use. . . . only $14.95

Black & Decker
UTILITY PORTABLE ELECTRIC TOOLS

IN THE TERRITORIES . . .

The *BULLARD CO.*, Bridgeport, Conn. — Six new field sales offices. Locations of these offices and personnel in charge are: Chicago district — *CLIFFORD H. HAGBERG* and *JAMES L. SHAY*, 6645 W. North Ave., Oak Park, Ill.; *EDWARD C. ROY*, 5625 W. Wells St., Milwaukee; *HENRY J. MALIN*, 2322 Third Ave., Rock Island, Ill.; Detroit district — *LAWRENCE J. BERGLUND*, 2216½ N. Meridian St., Indianapolis; *DAVID C. BERGLUND*, 436 N. Michigan St., South Bend; Boston district — *CHARLES E. ALLING*, 336 Washington St., Wellesley Hills, Mass.

For *KRITZER RADIANT COILS, INC.* — Four new appointments to the sales force: *ENGINEERED PRODUCTS CO.*, Palmer Bldg., Atlanta, Ga., represented by *F. E. BAIRD* and *R. B. KITCH*; *JOHN L. HARVEY* of Spokane, Wash.; *JOHN K. MacLEAN* of Providence, R. I.; and *SNOOK & ADERTON, INC.*, with offices in Amarillo and Lubbock, Texas.

For *DETROIT CONTROLS CORP.* — A new factory branch and west central regional sales office at 7122 Roosevelt Rd., Oak Park, Ill. Formerly located in Chicago, the regional office is headed by *T. C. McKEE, JR.*

For *ORR & SEMBOWER, INC.* — *YOUNG-STREETER CO.*, 6202 College Ave., Indianapolis, is the new representative in central and southern Indiana for the firm's "Powermaster" automatic steam generators and hot water boilers.

For *CANTON STOKER CORP.* — Three new representatives. In Chicago, *RUSSELL GRAEB*, formerly at the company's Cleveland office, has formed *COMBUSTION EQUIPMENT CO.* with offices at 4809 N. Claremont Ave. In Toledo, *JAMES F. GUEST & CO.*, 2157 Mansfield Rd., will represent the firm and in West Virginia, *LOYD A. WILDMAN* of *PYRO-NEERS, INC.*, P.O. Box 563, Charleston 22, is the new representative.

For *SUPERIOR VALVE & FITTINGS CO.* — *CHARLES A. MYERS* in Houston has been appointed sales representative in the southwest.

For *A. O. SMITH CORP.* — A new service branch of its Product Service Div. in Oakland, Calif. New manager is *GEORGE A. CARLSON*.

For *GENERAL CONTROLS CO.* — *DONALD P. SHAFER* is manager of the Columbus, Ohio, branch. Mr. Shafer will handle sales, engineering and service in that area.

For the *HAMMEL-DAHL CO.* — Two new offices in California. The Los Angeles office is at 3715 Santa Fe Ave. and the San Francisco office is located at 607 Market St. Both are under the supervision of *THOMAS H. PONTON*.

For *SERVEL, INC.* — *PAUL A. HILTON* has been named general manager of *SERVEL-NEW YORK CORP.*, a distributing subsidiary for the firm in New York, Long Island and Westchester.

For *AMERICAN CHAIN & CABLE CO., INC.* — Three organizational changes in the R-P&C Valve Div. *WILLIAM WAGNER*, who has been in the division's New York territory as a sales representative and later as district sales manager for the past 32 years, has been transferred to Reading, Pa. *JEROME V. GASSO*, who has been with the division since 1919 and has been district sales manager in Atlanta for the past 16 years, has been appointed district sales manager of the New York district with headquarters at 230 Park Ave., New York. *EDWARD A. ANTONELLI*, sales representative in the New York district for the past six years, has been appointed district sales manager of the Atlanta district with headquarters at 1101 Howell Mill Rd. N. W.

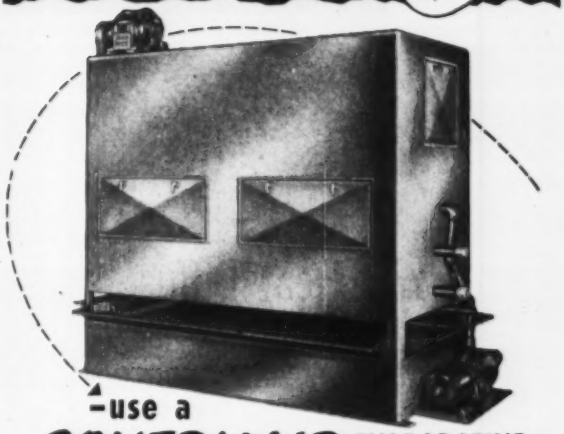
For the *YOUNGSTOWN SHEET AND TUBE CO.* — *FRANK C. STERLING* has been transferred from the Yoloy sales office in Youngstown, Ohio, to the district sales office in Pittsburgh.

For *CENTURY ENGINEERING CORP.* — Three new district sales managers. *E. J. METTELKA* is the new manager for the Wisconsin-northern Michigan area with headquarters at Marshfield, Wis. *ROY C. McDOWELL* is district sales manager for the territory covering western Pennsylvania, western New York, western West Virginia and eastern Ohio, with headquarters in Cleveland. *G. L. GRAHAM* will head the sales staff in the eastern-central district with headquarters in Columbus.

For *OWENS-CORNING FIBERGLAS CORP.* — *RICHARD S. RINGWALT* is assistant manager of the New York sales area. Mr. Ringwalt assists *JOHN A. McKAY*, sales manager, in directing sales of the various types of building and industrial materials.

For the Air Conditioning Div. of *REMINGTON CORP.* — A revamping of sales territories as part of the expansion of the sales organization. *E. M. JOHNSON* of Swarthmore, Pa., who has been a district manager responsible for part of the eastern seaboard from Philadelphia to Charlotte, now becomes southeastern regional sales manager for the areas from Trenton, N. J. south to Florida and west to eastern Tennessee, Washington, D. C., Harrisburg, Pa., and western Alabama. *JOHN P. MOFFITT* of Old Greenwich, Conn. is a new member of the sales force and will supervise sales in the six New England states and the Albany-Troy, New York area. The *W. H. LASSITER CO.*, 300 E. Main St., Richmond, Va., will cover the states of Virginia, North and South Carolina. *R. H. CASE*, Central Building, Seattle, will represent the firm in Washington, Montana, Idaho and Oregon. *R. E. TWEEDY*, 914 W. Madison St., Phoenix, is in charge of the southern California-Arizona area.

When water is a Headache...



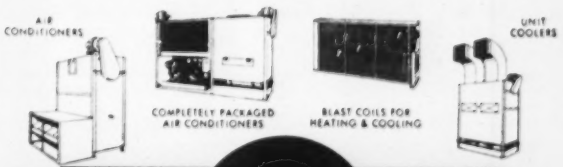
-use a GOVERNAIR EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

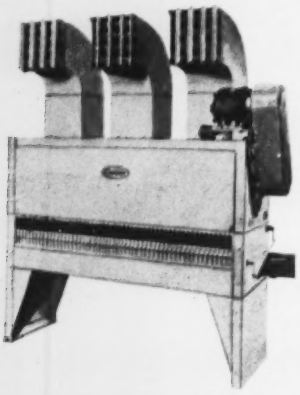
Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.



GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

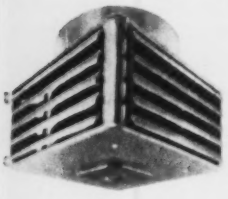
Lowest cost heat for large areas...



Carrier Heat Diffusers

Carrier blower-type Heat Diffusers heat *and* ventilate large enclosed areas in factories, warehouses, hangars, garages. Floor, wall or ceiling mounted models. Sectionalized. Quickly altered. Deliver air in practically any direction. For use with steam or hot water. There are 6 sizes to 2,390,000 Btu's. Air handling capacities from 4000 to 31,000 cfm.

For steam or hot water, Carrier propeller-fan type Unit Heaters are available in two models. Four-way Directed-flo vertical model (illustrated below, left) gives quick heat from higher ceilings, discharges in any of 4 directions. 7 sizes from 82,000 to 500,000 Btu's. Horizontal model directs warmed air from heights of 15 to 18 feet. Aerofin coil one row deep with widely spaced fins offers less air resistance, makes cleaning easier. There are 10 sizes from 21,000 to 200,000 Btu's.



Where gas is available, Carrier Gas-fired Unit Heaters give clean, economical heat. Propeller-fan model (above, right) and duct type both feature one-piece heat exchanger and combustion chamber of Aluminized Steel for extra years of better heat. AGA approved for all types of gas. There are 7 sizes from 70,000 to 230,000 Btu's.

Give your customers more heat for the money. Write Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

For *MINNEAPOLIS-HONEYWELL REGULATOR CO., INDUSTRIAL DIV. — DEVON W. FRYBACK* is sales manager of the eastern region with offices in Philadelphia. *O. B. PYLE, JR.*, is industrial manager of the mid-Atlantic area and *EDWARD J. KLEIN* is industrial manager for the firm's Philadelphia branch office.

For *BAILEY METER CO. — A. L. DANIELSON* is manager of the branch office at 1506 Kearney St., Denver. He succeeds *G. M. WALLACE*, who has recently been appointed an assistant sales manager in Cleveland. Mr. Danielson will supervise the sales and service work in Colorado, Wyoming, Utah, New Mexico and the Texas panhandle.

For *FEDDERS-QUIGAN CORP.* — Two new distributors for room air conditioners are *J. B. MITCHELL CO.*, Candler Bldg., Baltimore and *LUDWIG HOMMEL AND CO.*, 72 First Ave., Pittsburgh.

For *IRON FIREMAN CORP. — HOWARD B. EVANS*, who has been director of dealer development and sales training in the North Atlantic states, has been transferred to Los Angeles. He will be responsible for expanding the dealer organization throughout California. He has been with the firm since 1924.

For *AMERICAN WHEELABRATOR & EQUIPMENT CORP.* — Promotions and additions to its field sales personnel. *K. E. BLESSING* has been promoted to the post of district manager of the company's sales office at 53 Newark Street Bldg., Hoboken, N. J. *F. JOHN PICHARD* has been appointed to that office as sales engineer. *GEORGE F. BURDITT* is district manager of the company's Pittsburgh office at 91 Central Square, Pittsburgh 28. For the past few years he has been in charge of the company's Greensboro, N. C., office. Now at the Greensboro office is *GEORGE C. TOLTON* as district manager. Mr. Tolton was formerly in the Seattle office for more than six years.

For *JOHNSON SERVICE CO.* — Two new branch offices in Charleston, W. Va. and Roanoke, Va. *J. G. DOPTIS*, formerly of the Cincinnati office, will be the sales engineer in charge of the Charleston branch. The Roanoke branch will be headed by *JACK CLARK*, who transfers from the Richmond, Va., office.

A new firm, the *H. A. PIETSCH CO.*, 891 Heckler Drive, Pittsburgh, has recently been organized. The company will handle engineering and sales of equipment for commercial and industrial heating, air conditioning, processing and combustion in the area of western Pennsylvania, eastern Ohio and West Virginia. The company was formed by *H. A. PIETSCH*, who was chief engineer of the Heating Dept. of the Dravo Corp. for more than 18 years.

For *SCHNACKE, INC. — HOMER EDMONDSON* is manager of the firm's new office at 550 Fifth Ave., New

York. Mr. Edmondson has been with the York Corp. in a sales engineering capacity.

For *PARKER APPLIANCE CO.* — Two new district sales offices in Cleveland and Los Angeles. *EDWARD W. HOLLIS*, who has been manager of the rubber division in Cleveland, now is head of the office in Cleveland at 1770 London Rd. *DONALD T. BOODY*, for the past year Pacific coast sales engineer for the company's industrial products, now heads the new Los Angeles office at 5827 W. Century Blvd. Sales engineers with the Cleveland office are *HOWARD E. JACOB* in Cleveland, *GORDON MISCALL* covering southern Ohio, and *W. O. MURRAY* in Pittsburgh. Sales engineers located in Los Angeles are *JAMES K. DYSART*, *R. H. WAGNER* and *E. M. YOUNG*. *E. C. ROBINET* will operate from San Francisco and *D. N. ALLENSWORTH* will cover industries located in and about Seattle.

For *WESTINGHOUSE ELECTRIC CORP.* — Six franchises awarded to sell air conditioning equipment. The firms are: *JOHNSON-HILLIARD, INC.*, Kingsport, Tenn.; *GORDON L. HAYES*, Troy, N. Y.; *J. M. FINK CO., INC. and MUSSELMAN'S*, Lancaster, Pa.; *J. M. STEINHARDT, INC.* of Albany, N. Y., and *VENT-O AIR CONDITIONING CORP.* of Brooklyn.

Westinghouse also has announced the establishment of a branch office at Atlanta, with *THOMAS FULLER, JR.*, as manager. Since 1948 he has been manager of the Chattanooga branch office. *J. J. HILL* was appointed manager of the Chattanooga office to replace Mr. Fuller. *E. P. ATHENS* has been named manager of the Jacksonville, Fla. office and a new office has been established at Greenville, S. C., with *J. H. REEVES* as manager.

For *RELIANCE ELECTRIC & ENGINEERING CO.* — Transfers and appointments in the sales department. The *ARMATURE & ELECTRIC MACHINE CO.*, with offices at 1708-10 Jackson St., Omaha, and 1435 Keosauqua Way, Des Moines, is the new sales agent and distributor of the firm's motors and motor drives in those cities. *DALE D. DROLLINGER*, a member of the sales application engineering staff in Cincinnati, becomes branch manager at Rockford, Ill. *DANIEL J. DONNELLY* takes over Mr. Drollinger's position in Cincinnati. *JOHN M. DUFF* is joining the sales application engineering staff at Boston and *GEORGE P. LOOMIS, JR.* takes on sales application engineering duties in Syracuse.

For *FRED H. SCHAUB ENGINEERING CO.* — *V. J. ESWORTHY & CO.* is exclusive representative in the Washington-Baltimore area for the Chicago firm.

Three new representatives have been named by the *FARR CO.* of Los Angeles. They are the *JOHNSON FILTER SALES CO.*, Cleveland, the *PITTSBURGH AIR FILTER SERVICE CO.* and *AIR FILTER SALES & SERVICE-DETROIT*.

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

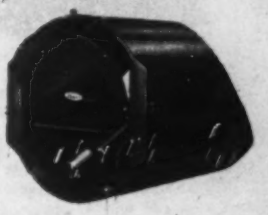
FIELD CONTROL DIVISION

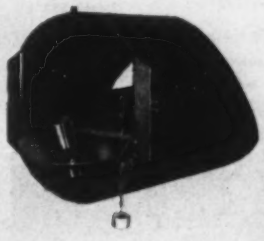
of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division, — Cranes, Hoists

UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.





DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

FOR COAL AND ORE THAWING SHEDS

many

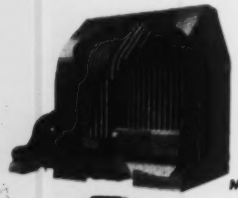
RAILROADS

specify LEE

Lee Direct-Fired Heaters have efficiently serviced Thawing Sheds for 30 years giving trouble-free operation.

The skill, integrity and responsibility of the entire Lee Corporation is your guarantee of sound engineering.

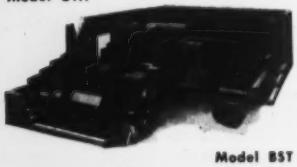
We maintain a Staff of Engineers to give you complete Lee engineering service and who will furnish data to suit your needs, promptly upon request.



Model UTH

THERE'S NO HEATING OR AIR-REPLACEMENT PROJECT TOO LARGE FOR LEE HEATERS

Model TSE



Model BST

LEAN TO LEE . . . *Specify Lee*

Complete engineering data on request

Representatives in all principal cities

SPECIFY LEE the completely engineered heater

LEE CORPORATION

1011 TATNALL STREET, WILMINGTON, DELAWARE

BALTIMORE, MD CHICAGO, ILL.

MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING—April 14-16, Iowa State College, Memorial Union Hall, Ames; April 21-23, American Legion Hall, 727 E. Wisconsin Ave., Milwaukee; April 27-29, Masonic Temple, Kalamazoo, Mich.; May 5-7, Hampton Institute, Hampton, Va.; May 12-14, Raleigh, N.C.; May 19-21, Atlanta, Ga.; May 25-27, Tampa, Fla.; June 2-4, Pittsburgh; June 9-11, Binghamton, N.Y.; June 16-18, Burlington, Vt.; June 23-25, Boston; June 29- July 1, New Haven, Conn. Tuition for the school is $23.00. Students wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York.

NEW JERSEY SOCIETY OF PROFESSIONAL ENGINEERS, INC., 86 E. State St., Trenton — 29th annual convention and exhibition, April 17-18, Hotel Essex House, Newark.

NATIONAL INDUSTRIAL HEALTH CONFERENCE — April 19-24, Los Angeles. Main topic of discussion will be new developments in methods for protecting and improving the health of the American worker and of insuring his safety. Participating professional groups are the American Conference of Governmental Industrial Hygienists, Navy Industrial Health Organization, American Association of Industrial Dentists, American Industrial Hygiene Association, and the American Association of Industrial Nurses.

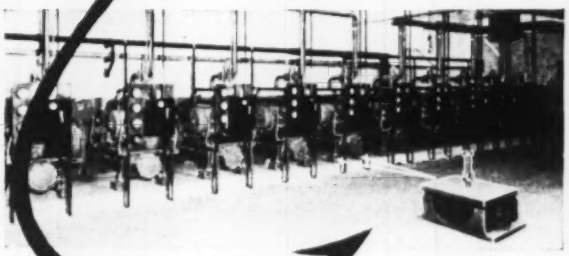
OIL-HEAT INSTITUTE OF AMERICA, INC., 6 East 39th St., New York 16 — 31st annual convention, April 20-21, Edgewater Beach Hotel, Chicago. Some of the topics to be covered in the general sessions are: Comfort Trends in Heating; The Ways to Increased Profits in the Heating Business; The Ever Increasing Replacement and Modernization Market, and How We Develop Men for Commercial-Industrial Jobs. The sessions will be made up of short talks, panels and forums.

NEW YORK ACADEMY OF SCIENCES and *ASHVE* —Joint sponsorship of a two-day conference on basic odor research correlation. The meeting will be held April 23 and 24 at the Barbizon Plaza hotel, New York. Speakers will discuss the odor problem in industry and sciences. ASHVE headquarters is at 62 Worth St., New York 13, N.Y.

AMERICAN ASSOCIATION OF SPECTROGRAPHERS — Symposium on "Emission Spectroscopic Determination of Metals in Non-Metallic Samples," May 1, Chicago. Chairman is J. P. Pagliassotti, Standard Oil Co., Box 431, Whiting, Ind.

ELEVENTH ANNUAL ANTHRACITE CONFERENCE —May 7-8, Lehigh University, Bethlehem, Pa., sponsored by the university and the Anthracite Institute. Latest developments in the distribution, utilization, economic and hygienic aspects of anthracite will be discussed.

STOP VIBRATION



with **KORFUND VIBRATION CONTROL**

Problem: When erecting a new office building, a prominent refrigeration equipment manufacturer wanted to install 41 of his units in two penthouses. Light-weight flooring with 40 foot spans between columns was planned. Vibration and noise transmission had to be prevented.

Solution: Korfund steel spring Isolators and Elasto-Rib pads completely prevented vibration and noise transmission, eliminated all bolting to the floor, and made economical light-weight floor construction possible.

In Air Conditioning, Korfund Vibration Control has paid off in dollars and cents for thousands of Engineers and Contractors, because Korfund units reduce transmitted vibration and:

- Permit installation anywhere in apartment, public, and industrial buildings
- Decrease original building and foundation costs
- Permit installation without reinforcing floors
- Lengthen machine life
- Permit higher operating speeds
- Reduce maintenance costs
- Insure quieter operation

We'll gladly send more information on Korfund Vibration Control for compressors, fans, pumps, boilers, air conditioners and other equipment, write today for your free copy of Bulletin #2, or see our catalog in Sweet's Files.

For specific recommendations, contact us or your local Korfund office. A half century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

48-01F Thirty Second Place, Long Island City 1, N. Y.
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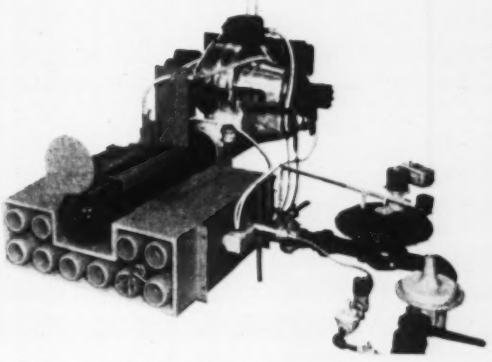
WEBSTER DUONETIC*

for Dual Fuel Firing



The WEBSTER DUONETIC* now offers unsurpassed economy, efficiency and trouble-free operation in the combination oil and gas firing equipment field. Never before have both fuels been burned so well so simply.

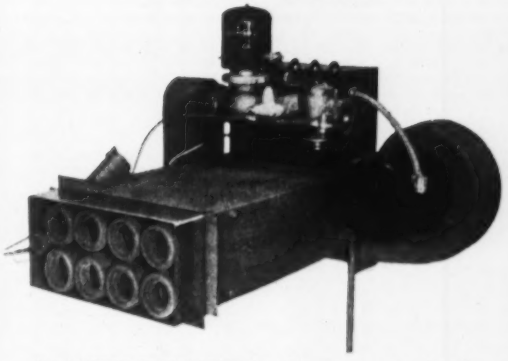
You can rely on the usual WEBSTER quality to provide you with the best.

Both burners employ electric ignition; constant electric ignition on the oil burner, and electric ignition for the gas burner safety pilot.

WEBSTER DYNETIC*

Forced Draft

GAS BURNER



The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

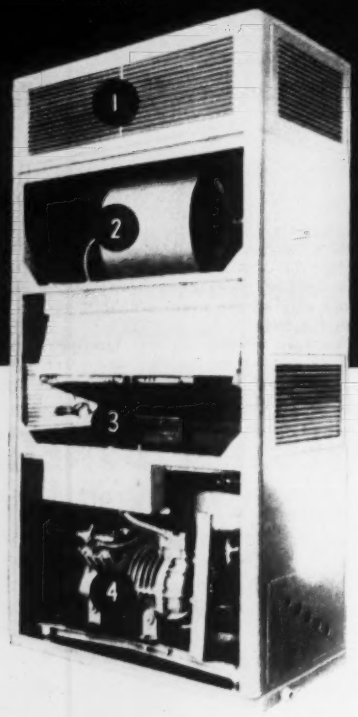
The burner is now available in 13 sizes for natural gas up to and including 300 h.p.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

AIR CONDITIONING UNITS HAVE TO BE RELIABLE...

Every time you recommend an air conditioning unit, you lay your reputation on the line. The unit has to meet the requirements of the job in each and every case. With BAKERAIRE, constant, accurate output is assured by balanced functioning of all parts.



1. Plenum diffuses air in any direction by simple adjustment of louvres.
2. Slow speed, full air capacity of the Fan Section balances with
3. The Coil Section, in which a 5 row coil has ample surface to remove moisture and heat, balanced with
4. The quiet efficient Compressor Section where the controls are integrated for automatic operation and complete safety protection. For final protection the interlock relay prevents short cycling of the compressor unit.

These features cut installation and maintenance time costs:

All water connections are run to an external utility panel, eliminating inconvenient internal connections

All electrical connections are integrated in one panel in front of the unit

All functional parts are easily accessible through the removable side panel

For further information, just write to:

BAKERAIRE CORPORATION
South Windham, Maine
Offices in Principal Cities

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION — 64th annual convention, May 13-16, Edgewater Beach Hotel, Chicago. Secretary, Joseph C. Fitts, 1250 Avenue of the Americas, New York 20. Joseph S. Kearny, president of the Northwestern Heating & Plumbing Co., 1905 Greenleaf St., Evanston, Ill., is chairman of the convention committee.

AIR POLLUTION CONTROL ASSOCIATION, 4400 Fifth Ave., Mellon Institute Building, Pittsburgh — Annual meeting, May 25 to 28, Lord Baltimore, Baltimore.

ANNUAL WISCONSIN POWER CONFERENCE AND EXPOSITION — June 3-5, Schroeder Hotel, Milwaukee. Sessions will include educational papers and audience participation panel discussions. The exhibit will be sponsored by local representatives of manufacturers of power equipment and allied products. Secretary of the conference is Lester E. Hoppe, 2335 N. 58th St., Milwaukee 10.

NATIONAL ASSOCIATION OF BUILDING OWNERS AND MANAGERS OPERATING EXHIBITS, 134 N. LaSalle St., Chicago 3 — June 7-11, William Penn Hotel, Pittsburgh. Sponsored by the association's Operating Methods and Equipment Committee, the exhibit will have displays of all products and services needed to run modern commercial buildings.

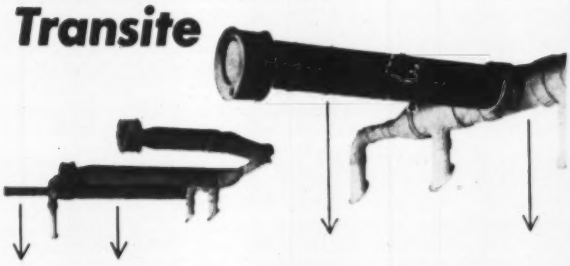
NATIONAL DISTRICT HEATING ASSOCIATION, 827 N. Euclid Ave., Pittsburgh 6. — 44th annual meeting, June 9 to 12, Lookout Mountain Hotel, Chattanooga, Tenn.

FOURTH ANNUAL STORE MODERNIZATION, BUILDING AND MAINTENANCE SHOW, Madison Square Garden, New York, June 9-12 — Sponsored by the Store Modernization Institute, 20 E. 55th St., New York 22, it will cover physical properties and operation of retail stores including warehousing and distribution.

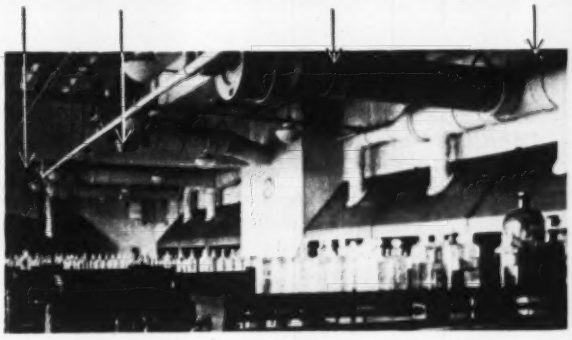
AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18. — National Spring Technical Meeting, June 16 to 19, 1953, Shamrock Hotel, Houston. Includes a four-day Welding and Allied Industry Exposition in the Shamrock Hall of Exhibits. The exhibits will be presented by manufacturers who sell products for welded fabrication, weldments, welding processing, gas cutting, brazing, finishing, tooling, gaging, testing, stress relieving, X-raying, servicing and handling.

AMERICAN SOCIETY FOR ENGINEERING EDUCATION—61st annual meeting, June 22-26, University of Florida, Gainesville. Plans call for more than 100 conferences including a series on atomic energy engineering; lectures on digital computers and discussions by industrial economists. General chairman is Prof. John C. Reed, head of mechanical engineering at the University of Florida. The meeting will be preceded by a three-day summer school, beginning June 20, sponsored by the society's industrial engineering division.

SOLVED with Transite



...a tough problem of venting corrosive fumes and gases



because TRANSITE INDUSTRIAL VENT PIPE

is corrosion-resistant, long-lasting

HERE are 3 good reasons why the Transite* Industrial Vent Pipe shown here can be expected to keep down the costs of venting aggressive gases in the laboratory, and to do it for a long time to come:

1. **It's made of asbestos and cement—cannot rust or rot.**
2. **It needs no painting or any other preservative finish —ever—whether used indoors or out.**
3. **It is resistant to practically all corrosive fumes, mists and gases.**

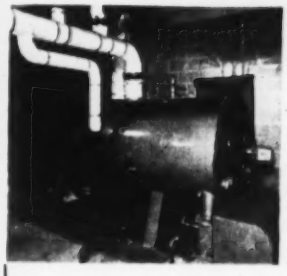
Transite Industrial Vent Pipe—as vents, ducts, stacks for indoor or outdoor use in laboratories and industrial plants—is adaptable to practically any requirement. It is quickly and economically installed. It is light, strong and durable . . . is easy to assemble . . . can be worked with ordinary tools. It comes in sizes up to 36″ in diameter, and there is a complete line of fittings available for every need. For further details on Transite Pipe for your industrial venting problems, write to Johns-Manville, Box 60, New York 16, N. Y.

JM

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE Industrial Vent PIPE

3-Way Cost Savings On School Job With Steam-Pak Generator



Above—Entrance to the new Essex County Colored School, Tappahannock, Va., which is the first unit of a consolidated school unit.

Left — Model SPL-50-5 Steam-Pak Generator, manufactured by York-Shipley, Inc., York, Pa., installed in school boiler room. Space provided for two more boilers when additional units of school are added.

TAPPAHANNOCK, VA. — The new $205,199 Essex County Colored School, which was opened here last fall, is heated by a 50-hp. low pressure Steam-Pak Generator which was selected because it offered three-way cost savings.

"The Steam-Pak Generator was selected because original building costs were reduced by omitting the stack, installation costs were lower because of simplicity of hook-up, and, most important, for economy of operation," J. Henley Walker, Jr., Architect of Richmond, Va., reported.

The new school building is the first of a consolidated school and includes 10 classrooms, library, general purpose and cafeteria room, kitchen, office suite and clinic. Additional units planned for the school are six more elementary classrooms and high school facilities. Space has been provided in the boiler room for additional steam generators.

The heating system was installed by Virginia Plumbing & Heating Co., Inc., Richmond, Va., for Howard Mitchell, Richmond, Va., General contractor. The Steam-Pak Generator was sold by Pelouze Sales Co., Hillcrest Bldg., Richmond 19, Va., distributor.

Other new Virginia schools which have installed Steam-Pak Generators, according to Henry L. Pelouze, manager of Pelouze Sales Co., include Carter G. Woodson Elementary School and Hopewell High School Gymnasium, Hopewell; Walker-Grant and James Monroe High Schools, Fredericksburg, and Dunbar, Booker T. Washington, and Bankhead Magruder Schools, Newport News.

YORK-SHIPLEY, INC. - Industrial Division, York 5, Pa.

GET MORE STEAM-PAK FACTS TODAY

Please send me additional data on York-Shipley Steam-Pak Generators.

Name.....

Company.....

Address.....

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O.K.
to Re-order
For Commercial, Industrial and Institutional Installations
Sizes 1 to 60 gph capacity. Only oil burner designed especially to burn No. 5 oil without preheating. Gas, combination gas/oil burners also available.

Fuel savings up to 30% make HEV-E-OIL Burner *best buy* for you!

No wonder HEV-E-OIL Burner customers are *repeat* buyers! Hundreds of commercial and industrial buyers say HEV-E-OIL Burners helped them save up to 30% on fuel costs by *burning thrifty heavy oils*. Here's what typical owners* say:

"— since installing your HEV-E-OIL burners, we have been using the No. 5 grade oil, this has saved us approximately $900.00."

"— we formerly used 30,000 gallons of light oil per year. Now, with Cleaver-Brooks HEV-E-OIL Burners, we only consume 25,000 gallons of No. 5 oil, which gives us a saving of $700.00 per year."

*Names on request

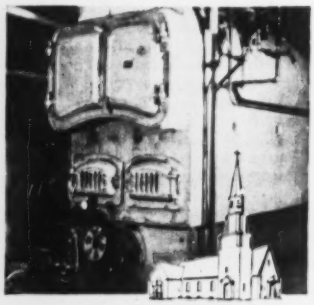
Here's how to get started cutting heating bills 30%

1 Add up your present heating bills — then deduct 30%. This is your approximate saving with HEV-E-OIL Burner.

2 Write for Bulletin AD-102— highly illustrated, with more fact-packed reasons why it will pay you to convert to HEV-E-OIL.

3 Get in touch with your Cleaver-Brooks HEV-E-OIL dealer — he will be glad to make a free survey without obligation.

REMEMBER . . . If you are using 6,000 gals of oil, or more than 45 tons of coal per year — the HEV-E-OIL Burner is the *best buy* for you! Write direct for name of dealer nearest you.



HEV-E-OIL Burner installed at Bay Shore Lutheran Church, Milwaukee, Wis.

Cleaver-Brooks

BURNER DIVISION • CLEAVER-BROOKS COMPANY

Dept. D, 381 E. Keefe Ave., Milwaukee 12, Wisconsin

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—Spring meeting, June 27-July 1, Lake Placid Club, Lake Placid, N.Y. The 1953 winter meeting will be held in Washington, D. C. and the 1954 semi-annual meeting in Seattle. The December 1954 annual meeting will be held in Philadelphia. This meeting will mark the 25th anniversary of the Philadelphia section and the 50th anniversary of *ASRE*.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Semi-annual meeting, June 29, 30, July 1, Denver, Colo. For further information see page 147.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—1953 annual meeting, June 29-July 3, Chalfonte-Haddon Hall, Atlantic City.

AMERICAN INSTITUTE OF WHOLESALE PLUMBING & HEATING SUPPLY ASSOCIATIONS — Second annual convention, September 20-23, Waldorf-Astoria, New York. Convention chairman is M. W. Dennison of Braman, Dow and Co., Boston.

INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12 — Eighth National Instrument Exhibit, September 21-25, Sherman Hotel, Chicago.

INTERNATIONAL CHURCHMANS EXPOSITION, 19 S. LaSalle St., Chicago 3 — Second annual exposition, October 6-9, Chicago Coliseum. Hall of Church Designs and International Church Buildings Forum will be featured.

SOUTH CENTRAL REGION, NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2 — October 7-9, Mayo Hotel, Tulsa. This region consists of the states of Colorado, Kansas, Oklahoma, Arkansas, Louisiana, Texas and New Mexico.

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS—Ninth annual meeting, October 8-9, Sheraton Hotel, Chicago. Sponsored by the Illinois Institute of Technology, Chicago 16, the conference director is Otmar E. Teichmann.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17—35th annual convention, October 26-28, Kiel Auditorium, St. Louis. Hotel reservations are available from the Hotels Convention Bureau, American Gas Assoc., Rm. 405, 911 Locust St., St. Louis 1.

EIGHTH ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION, 1346 Connecticut Ave., N.W., Washington 6, D.C. — November 9-12. Cleveland Public Auditorium, Cleveland.

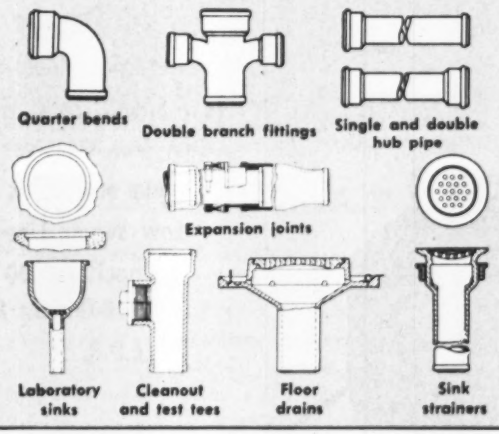
The permanent drain pipe installed by ordinary plumbing methods

DURIRON ACIDPROOF DRAIN PIPE AND FITTINGS

Duriron is a high silicon iron alloy highly resistant to most commercial acids at practically all temperatures and concentrations. It is not a coating—the entire thickness of the pipe wall is resistant to abrasion and erosion as well as to corrosion.

The labor cost of installing Duriron is the same as with ordinary cast iron soil pipe. Normally the initial cost is the final cost since Duriron will generally outlast the building in which it is installed.

SOME OF THE MORE THAN 60 STANDARD DURIRON FITTINGS



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Write for Bulletin PF/1

THE DURIRON COMPANY, Inc.
404 North Findlay Street
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DURIRON
LOOK FOR THE NAME ON EVERY PIECE

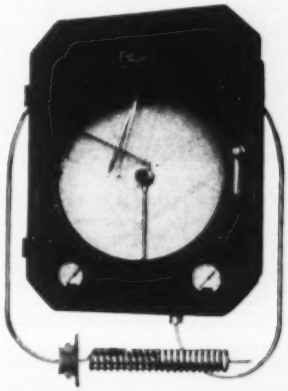
Taylor keeps you from blowing hot and cold!

Whether you use air conditioning for human comfort or for the manufacturing or storage of sensitive or perishable products . . .

Whether you need a single control instrument for an isolated application, or multiple controls for a complete system . . .

Taylor can help keep the air conditioned at the temperature you want, within very close limits.

We make a full line of accurate control instruments for practically every air conditioning need. And we'll be glad to work with you or your consulting engineers or contractors to find the answer to your individual problems. Ask your Taylor Field Engineer, or write Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.



TAYLOR FULSCOPE® TEMPERATURE CONTROLLER

No. 121RV120 is equipped with a special pre-formed capillary bulb designed for accurately measuring air temperatures. This controller precisely positions such devices as lever motors, diaphragm valves, dampers, etc., to produce the required air conditioning result. Available for on-off control, throttling control, or highly precise control; to reposition valves, lever motors or other pneumatically controlled devices.

Automatically compensates for changes in occupancy or processing loads.

Controls refrigeration compressors, automatically starting and stopping them according to the demand for artificial refrigeration.

Prepares for Summer or Winter changeover automatically by controlling fresh air and exhaust damper diaphragm valves.

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

NEW BOOKS & REPORTS

Handbook on Air Cleaning

This 80 page booklet prepared by Sheldon K. Friedlander, Leslie Silverman, Philip Drinker, and Melvin W. First will prove a useful addition to the library of any engineer interested in air cleaning equipment. While data was developed and accumulated at the request of the Advisory Stack Gas Problem Working Group of the Atomic Energy Commission to make available to their personnel current information on air cleaning methods and yardsticks for judging their effectiveness, the approach to the project by the authors has been broad and inclusive. Surveys and descriptions cover the current range of available air cleaning equipment, making the data of interest to all types of users including those where standards of cleanliness are substantially below those of any AEC needs. The report is broken into four major chapters and a bibliography which tabulates 75 reference works reviewed in the preparation of the project.

Chapter 1 briefly discusses the theory and the probable range of effectiveness of the various methods of removing aerosols suspended in a gaseous media. Factors involved in flocculation, precipitation, and diffusion are analyzed. The chapter makes an excellent introduction to the basic theory involved in air cleaning units operating on any of those principles.

Chapter 2 describes different types of air cleaning equipment. The breakdown gives detailed comments including probable range of effectiveness for settling chambers, dry centrifugals, wet type collectors, air filters, fabric arresters and electrostatic precipitators. This chapter is profusely illustrated with numerous commercial design cuts to show principles of operation. A critical appraisal of the different groups includes advantages, shortcomings, power requirements and limiting factors to be considered in their application.

Chapter 3 is devoted to a discussion of performance and evaluation of air cleaning equipment. Description of test methods, tabulation of their characteristics, and a discussion of their limitation is included in this chapter. Approximate cost data for various designs of air cleaning equipment has been compiled and performance data covering 76 separate performance reports has been accumulated both from field research on the part of the authors and through industry and technical press surveys. While the performance data is probably the most controversial portion of the entire publication, the authors are to be commended on the effort exerted to obtain such data. The influence that concentration, mass median particle size, specific gravity and temperatures can have on air cleaner performance is clearly indicated although the data should be used with caution. At best it represents spot checks under a given set of conditions without common test methods or procedures.

Data reported has been obtained under a wide range of conditions. Laboratory data must be recorded under simulated conditions. Accurate field data is difficult to obtain with the small sample volumes handled and the problems of good sampling locations. Consequently, for any given

LOW PRESSURE SYSTEM
Condensate Pumps

weil Dependable PUMPS

weil TVC Pumps
Low Return Connection
Low Speed, Long Life
Cast Iron Receiver
Single or Duplex
Low Water Line
Capacities 500 to 10,000 Sq. Ft. E.D.R.

For Single Units
Dimensions: 10 gal. receiver
Diameter—21"
Height of return above floor—6⅞"

For Single or Duplex Units
Dimensions: 15 gal. receiver
Diameter—25½"
Height of return above floor—7 3/16"

Fig. TVC 126

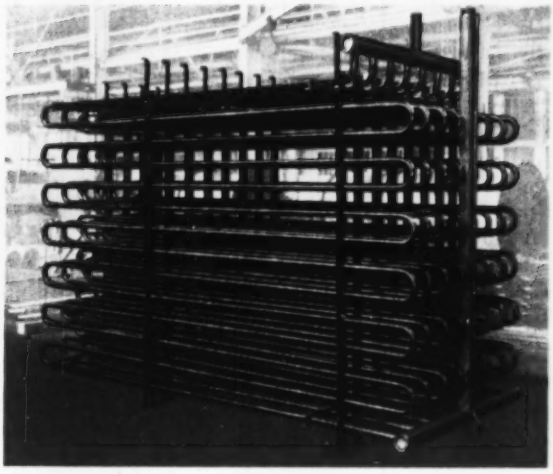
ASK FOR BULLETIN TVC 300

weil PUMP CO.
1530 N. FREMONT ST. CHICAGO 22, ILL.

Available from JOBBERS' STOCKS

Check Your Refrigeration Needs *NOW!*

NOW is the time to get set for warm weather . . . and Whitlock is ready to help you with your refrigeration requirements. As with this recently completed Whitlock refrigeration coil, trouble-free operation is a built-in characteristic of Whitlock equipment. Each Whitlock unit gives efficient low-cost service because it is carefully designed, competently constructed, and fully tested in our plant.



Ammonia coil for ice plant, fabricated of 1¼" std. black pipe with 3" std. pipe headers. Notice the supports which assure rigidity in service.

Whitlock offers you a wealth of experience in the manufacture of condensers, receivers, welded headers, prefabricated piping, coils, and allied products. Whether you are freezing ice or keeping customers comfortably cool, it will pay you to consult Whitlock on your new and replacement refrigeration needs. Write for Whitlock Bulletin No. 140 describing the full line of Whitlock Refrigeration Equipment.

THE WHITLOCK MANUFACTURING CO.

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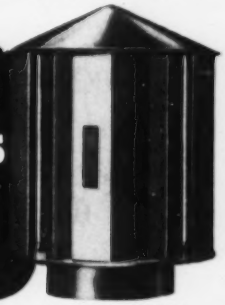
BUYING VENTILATORS? GET THE FACTS FIRST...

Ask for CERTIFIED Ratings... It's the only way you can be sure ventilator performance will measure up to the ratings claimed for it.

Ask for Ratings Based on VARIABLE Wind Conditions... if you want a ventilator that performs efficiently under *all* wind conditions. Ratings of most ventilators are based on *horizontal* wind tests only, or tests made at favorable angles. Many ventilators down-draft at other angles.

Breidert Air-X-Hausters

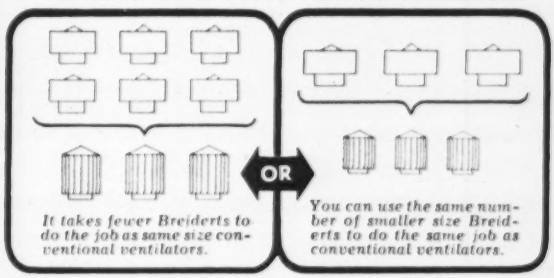
PROVIDE SAFE, SURE VENTILATION NO MATTER WHICH WAY THE WIND BLOWS...



Patent No. 2269428

Certified tests show that the actual capacities of Breidert Air-X-Hausters are greater than published ratings (barring interior negative pressures). Stationary, no moving parts, nothing to jam or get out of order. *The Breidert is the pioneer ventilator* to publish certified ratings based on tests* made with wind blowing in all directions.

The Breidert Delivers Better Results at Minimum Cost



It takes fewer Breiderts to do the job as same size conventional ventilators.

You can use the same number of smaller size Breiderts to do the same job as conventional ventilators.

Get *all* the facts! Write today for complete Engineering Data Book, including certified capacity ratings. Address Dept. A.

✔ Every businessman should read "Plain Facts and Simple Figures," written by G. C. Breidert. This thought-provoking article pertains to the problems of every American businessman. The first twenty lines will open your eyes! Write for a free copy.

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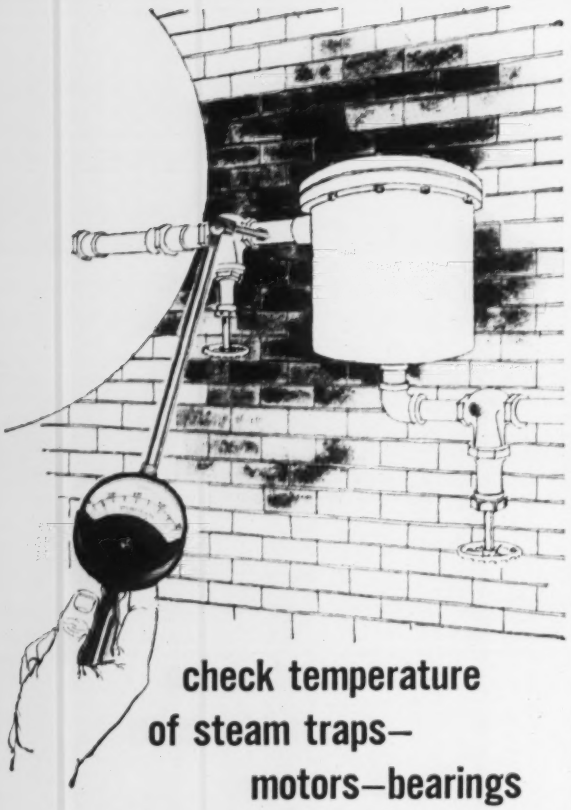
*By Pittsburgh Testing Laboratories



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 513, 420 N. LaSalle St., Chicago 10, Ill.

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collector design, a large number of field tests on different materials would be necessary before one design of collector could be evaluated against another make operating on similar collection principles. It must also be recognized that there are many methods of measuring particle size and that results reported will be influenced by the method used.

Chapter 4 reviews the specific problems introduced by radioactive aerosols and as such will be of most interest to engineers confronted with such problems.

Specific Comments

Using our company's experience as a background, there are items in the publication that prompts the following comments.

a. Settling chambers as practical air cleaning devices appear to be over emphasized. They are not used extensively in industry except as an incidental design feature used where need for an entering air plenum chamber is indicated in collector design. Turbulent rather than sinuous flow will exist and effective removal of particles under 100 microns is seldom obtained. The authors imply that settling principles are important for particles as small as 10 microns.

b. In wet collectors employing the impaction principle, wetability of the dust has not been a significant characteristic in equipment selection. The use of wet collectors for collection of stearates, carbon black, tar impregnated fibers illustrate the ability of wet collectors to mechanically breakdown the surface tension characteristics and successfully wet particles where vigorous shaking of such particles in a test tube would have left particles unwetted.

c. While centrifugal forces can be used to obtain effective collection on particles over 1 micron, such performance is restricted to laboratory devices handling a few cubic feet per minute. In commercial air cleaning devices, effective collection of particles smaller than 10 microns is questionable.

d. From available data on the reverse jet fabric arrester, it appears that velocities of 35 fpm through the fabric are high for usual applications and that a 15 fpm rate would be more comparable with the usual 2 to 3 fpm through conventional bag collectors.

e. Use of fabric arresters for atmospheric air filtration will have few applications in industrial air filtration due to the cost, space, and pressure drop of the fabric arrester compared to commercial air filters.

f. Maximum operating temperatures reported for cloth arrester fabric are peak temperatures for short duration. Usual recommended temperatures for air cleaning service are cotton, 180 F; wool 200 F; orlon 275 F.—

Developed by the Dept. of Industrial Hygiene, School of Public Health, Harvard University for the U. S. Atomic Energy Commission, this book is available from the Superintendent of Public Documents, Washington 25, D.C. at 15 cents a copy.—Reviewed by John M. Kane, Manager, Dust Control Div., American Air Filter Co., Inc.

Blueprint Reading for Welders

The fourth edition of *Simple Blueprint Reading With Special Reference to Welding and Welding Symbols* has recently been published. This is a new and enlarged edition of a book for welders and others engaged in the fabrication of machinery. It is intended as a guide

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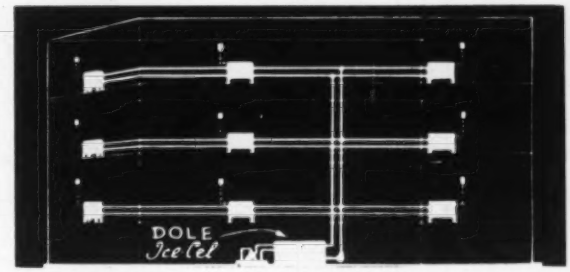

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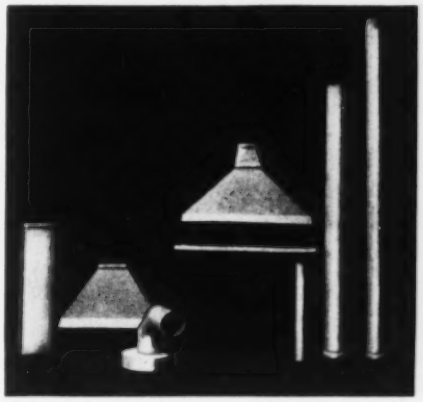

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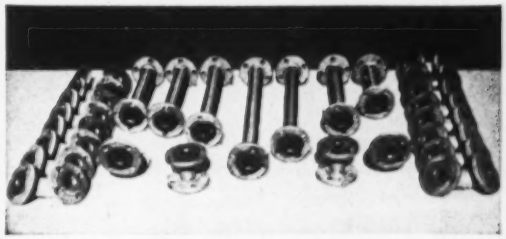

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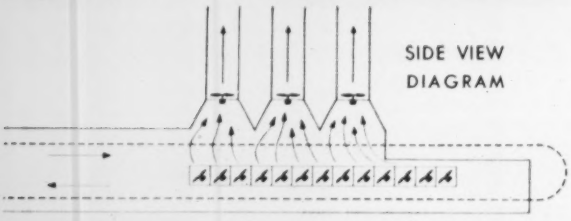

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to a clear understanding of blueprints and how to use them in mechanical fabrication and construction. Special attention is given to the use of welding symbols. Large drawings are used to illustrate the interpretation of blueprints. To practice visualizing drawings, numerous blueprints taken from actual shops are reproduced along with photographs of the objects as they are made.

The book explains subjects such as perspective drawing, isometric drawing, sight projection, center plane lines, dimensions, scales, sections, explanatory views, development of weld symbols, types of welds and gives questions and answers on these subjects.

Published by the Lincoln Electric Co., 22801 St. Clair Ave., Cleveland 17, the book is available for $1.00 in the United States and $1.50 elsewhere.

Pressure Vessel Code

ASME Unfired Pressure Vessel Code covers the design, construction, inspection and tests of unfired pressure vessels of carbon and low-alloy steels, nonferrous materials and high-alloy steel, fabricated by welding, riveting, integral forging and brazing. It includes recommendations for pressure relieving devices, stamping and recording.

Two mandatory appendices give design formulas, rules for bolted flanged connections and definitions. Sixteen non-mandatory appendices provide suggestions for using new material; a method for obtaining operating temperature of vessel walls in service; practices regarding internal structures, corrosion allowance, linings, design of supports; basis for establishing stress values for ferrous and nonferrous materials, capacity conversions for safety valves, etc.

As the rules in the 1952 Code cover the uses of all classes of materials and methods of fabrication that have been approved for Code construction, they are to be used without supplement from earlier editions or from code cases applicable only to earlier editions.

The Code, which is Section VIII of the 1952 ASME Boiler and Pressure Vessel Code, is published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, and is priced at $3.50.

Proceedings of Short Course for Architects

The University of Illinois has published a series of 24 papers presented last fall during a course for architects in planning for heating and air conditioning in small buildings. The course was conducted by the Dept. of Mechanical Engineering and the Dept. of Architecture in cooperation with the University of Illinois Division of University Extension.

Some of the papers reprinted in the *Proceedings of Short Course for Architects* are: Steam and Hot Water Systems, by Warren S. Harris; Warm-Air Systems, by R. W. Roose; Estimating Building Heat Losses, by J. Raymond Carroll, Jr.; Infiltration and Ventilation Problems in Small Buildings, J. R. Fellows; Sound Control in Air Conditioning, Prof. C. B. Looker; Structural Applications of Insulating Materials, Frank J. Kornacker; Condensation and Vapor Control, Ross J. Martin; and Research in Heating, Air Conditioning and Man's Physiological Response to Environment at the University of Illinois, by Maurice K. Fahnestock.

The paper bound volume is priced at $3.50 a copy. Orders for the Proceedings should be sent to Conference Supervisor, Div. of University Extension, 713½ S. Wright

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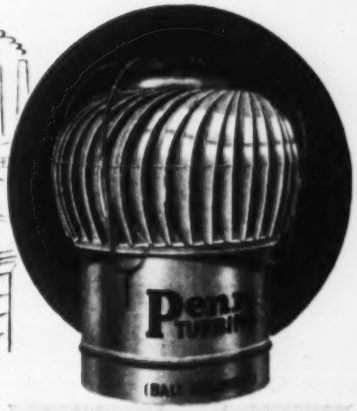

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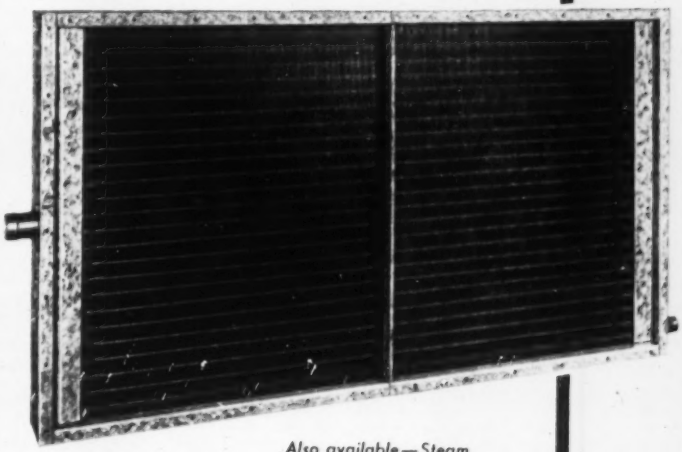

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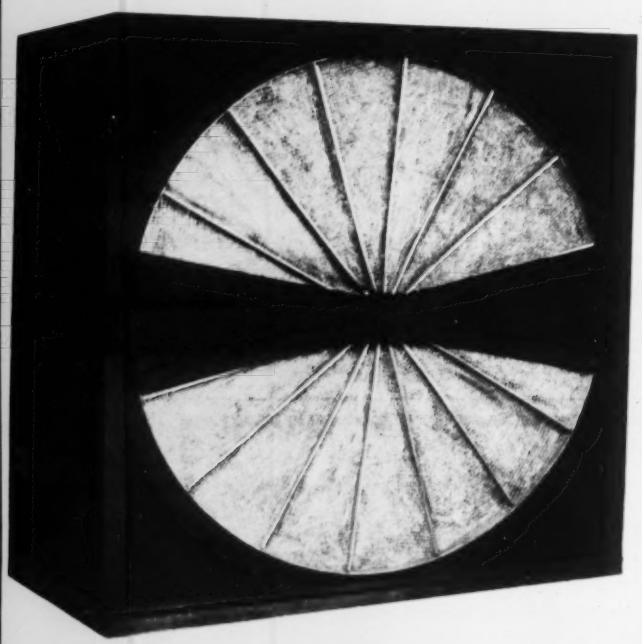

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Priced at $10.00 a copy, the cloth bound book is published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18.

Bibliography on Humidity

A list of references on the subject of humidity has been published by the U. S. Dept. of Commerce. Compiled by Francis D. Horigan, the literature survey covers the years 1945-51.

Humidity Studies contains 119 references, arranged by subject, each with a brief resume of the article. Subjects covered include: control, testing and instrumentation; foods; insecticides and pest control; metals; packaging and paper products; physical chemistry; physiology; plastics, coatings and adhesives; leather and leather products, and textiles.

The bibliography, identified as PB106382, may be ordered from the U. S. Dept. of Commerce, Office of Technical Services, Washington 25, D.C., at $1.00 a copy.

Standards for Steam Surface Condensers

The Heat Exchange Institute has published a new edition of its 20-page book, *Standards for Steam Surface Condensers*. It is a revision of the book on the same subject issued in 1939 and 1940 and it is one of a series of eight publications on different pieces of heat exchange apparatus. A new section on heat transfer rates is the result of tests conducted at Lehigh University and the new data shows the results of these tests, including corrections in heat transfer for different tube materials. Performance curves have been included to illustrate actual maximum performance. Another new section shows recommended sizes. The recommended vacuum pump capacities have been revised and recommended capacities for rapid evacuation are included.

Priced at $2.00, copies may be obtained through members of the Heat Exchange Institute or by writing directly to the institute at 122 E. 42nd St., New York 17.

District Heating Association Proceedings

The National District Heating Association has recently published the *Official Proceedings* of its 41st annual meeting held in 1950. Reports of the association's various committees are given including the committees on operating statistics, research, air conditioning, metering, steam losses, steam station engineering and the distribution com-

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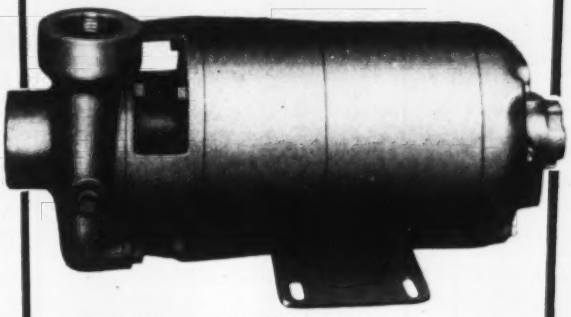

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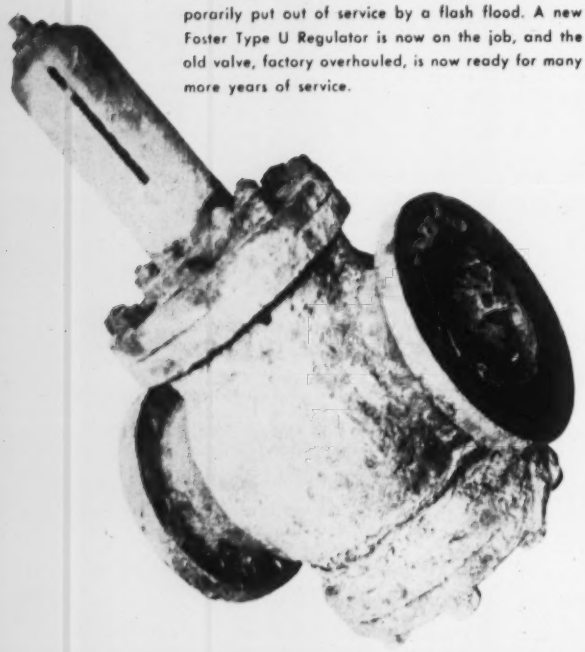

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mittee. Included in the committee reports are many technical papers.

A report of this meeting was carried in the August 1950 issue of *Heating, Piping & Air Conditioning*.

Published by the National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, the volume is priced at $10.00 a copy.

Radiology and X-Ray Bibliographies

Two bibliographies on X-ray methods have been compiled by Herbert R. Isenburger of the St. John X-Ray Laboratory. The first, a *Bibliography on Industrial Radiology*, 1950-52, contains 508 references and is priced at $2.00. The second, *Bibliography on X-Ray Stress Analysis*, second edition, 1953, contains 311 references and is priced at $4.00 a copy. Also included is a subject index to facilitate the use of the bibliography on stress analysis.

Copies may be ordered from the St. John X-Ray Laboratory, Califon, N.J.

OTHER BOOKS AND REPORTS

BODY TEMPERATURE, Its Changes with Environment, Disease and Therapy—by W. A. Selle, Ph.D., professor of biophysics and physiology, University of California Medical School, Los Angeles. Briefly, the book covers the importance of heat regulation, development of heat control, and normal values and variations of body temperature. A detailed review will be printed at a later date.

The book was published by Charles C. Thomas, 301-327 E. Lawrence Ave., Springfield, Ill. and is priced at $3.50 a copy.

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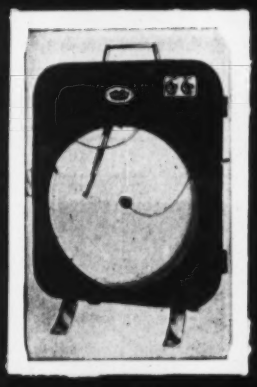

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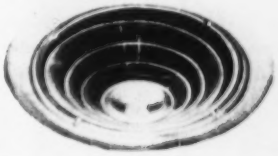

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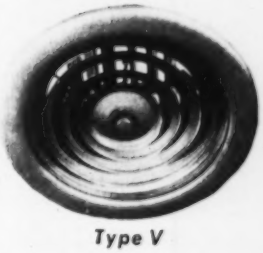

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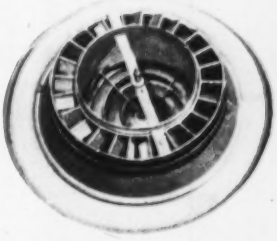

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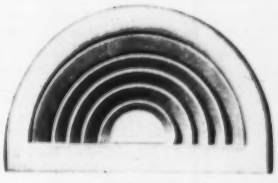

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Alloy Tubing Steels for High Temperatures

HPAC 101—Technical data card 146 discusses "Croloy 5", an alloy tubing steel for elevated temperature service. The manufacturer states that this steel has proved of value in refinery and other process industry applications as furnace tubes, piping and superheater tubing. According to the bulletin, it is resistant to corrosion from hot oil, hydrogen sulphide, elementary sulphur and organic sulphur in petroleum processing. Included in the bulletin is data on creep strength, physical properties, welding, fabrication and heat treatment. [Manufacturer: Babcock & Wilcox Co., Tubular Products Div., Beaver Falls, Pa.]

Arc Welding Accessories

HPAC 102—Arc welding accessories from electrode holders and ground clamps to protective clothing and headgear are described in booklet B-5151. All accessories are illustrated and specification data is supplied. Where several models of the same accessory are shown, the special application characteristics of each are discussed. [Publisher: Westinghouse Electric Corp., Box 2099, Pittsburgh 30.]

Arc Welding Uses

HPAC 103—How arc welding pays is the subject of this new 40-page book. More than 100 photographs show how arc welding is used in 18 different industries for production, maintenance and repair. Some of the industries covered are: automotive, construction, heating, machinery, petroleum, farming, railroad and ship building. Another section of the book shows the company's line of arc welders, electrodes and accessories. [Manufacturer: Hobart Brothers Co., Troy 1, Ohio.

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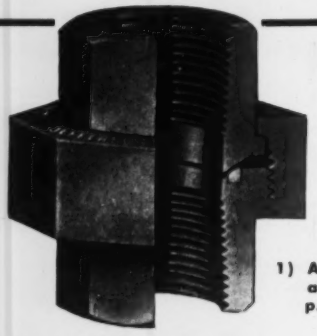

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You get highest return on your pipe union dollar by taking advantage of these Jefferson features all of which have been performance-proved.

Jefferson offers OWG 2000# to 2" and 1000# up to 4". The complete line includes AAR male and female unions, Endura 300#, Excel 250# and Master 150# unions. All types are also available with all-iron seats. Underwriters Approved

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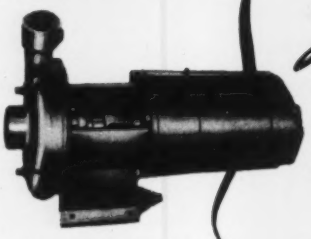

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Low cost utility pumps built for air-conditioning systems, food processing plants, circulating water for cooling towers, for sprinkling lawns, for swimming pools and hot water circulating. Choose capacity and horsepower (¼ thru 5) suited to your needs. Write for Bulletin JGP-2.

Since 1915—the industry's most complete line of pumps and water systems ...originator of jet pumps.

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QUICK PROFITS . . . EASY INSTALLATIONS . . . SATISFIED CUSTOMERS

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Now is the time to replace oil wasting burners with a Bankheat. It's the easiest selling that you can do today . . . selling that will make you a profit, and a new set of satisfied customers.

Bankheat Burners have an unequalled reputation for oil-saving efficiency. In thousands of homes they are powering boilers, boiler burner units and water heaters. For many years in many lands they have been building up a record of economical performance. They're fully automatic, precision built, easy to install, exceptionally dependable. They are today's best bet for dealers who want sales. May we send you the full story?

There's an automatic Johnson Burner for EVERY heating need.

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Builders of fine Oil Burner Equipment since 1903

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It's the *LOW DOWN* DIRT trapped by WILSON'S HAIR FILTERS that GUARANTEES LONGER LIFE

In Wilson *Hair* Filters the entire dust-holding capacity is completely utilized. This means, *no surface dust stopping only*, but Full-Depth Dust Trapping at its best . . . and many extra months of filter life.

The *reasons* are so simple:

1. The hair media in Wilson *Hair* Filters act in the same manner as Mother Nature's proven way of filtering the air you breathe. It's the *hair* that cleans the air . . . more easily, more effectively, more economically.
2. The multi-directional distribution of the hair in Wilson *Hair* Filters literally invites all dust and dirt to come in and be trapped throughout the entire filter interior.
3. Most brands of air filters require oiling on their inlet surfaces. This stops dust prematurely, loads up the incoming air side and materially shortens filter life.

Wilson Hair Filters are not oiled on the inlet side. Instead, they receive an even distribution of mineral oil *on their outlet surface*, which:

(a) augments the already amazing ability of the hair itself, to catch and hold dust, and—

(b) builds an impregnable barrier which halts dust and dirt after reaching the furthermost practicable penetration point.

WILSON & CO., INC.
(Air Filter Division) 4100 South Ashland Ave., Chicago 9, Ill.

Wilson Hair Filters are another quality product of Wilson & Co., world-famous for meat products, sports equipment, pharmaceuticals, hair products, etc.

The famous Edgeseal, the original *Hair* Filter with the patented self-sealing edge.

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Save delay. Save dollars. Save doubt. Send for FREE sample with details and prices.

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First in Interior Fire-Protection Equipment

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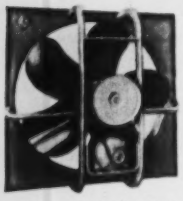

TYPE IND EXHAUST FAN
For factories, mills, theatres, schools, hotels etc. Features belt drive with ball bearing motor. Sizes from 24" to 72".

STEP-UP OUTPUT and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. CHELSEA Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended application. All ratings are certified by P.F.M.A. test methods to insure proper performance.

Write for Catalog No. 400 Complete data and specifications on fans and blowers for every industrial and commercial application—address Dept. V4.

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PLAINFIELD, NEW JERSEY

TYPE BB ALL PURPOSE EXHAUST FAN

TYPE PHD PENTHOUSE UNIT

TYPE PLP POWER LINE EXHAUST FAN

TYPE PLDU POWER LINE AIR BLASTER

Baseboard Heating

HPAC 104—Catalog (16 pages) completely describes the five types of baseboard that comprise the company's line. The catalog is designed to tell its story in pictures. Illustrations are used to show the features of the entire line, coil selection data, installation instructions, accessories and specialties that are optional with this equipment. Each type of baseboard is covered on an individual page which includes typical uses, cross-section drawings, accessories and all dimensions. A sample specification also is given. [Manufacturer: Kritzer Radiant Coils, Inc., 2901 Lawrence Ave., Chicago 25.]

Bronze Globe Valves

HPAC 105—Design and construction features of the firm's line of 125-lb pressure globe, angle and check valves are described and illustrated in circular No. 582. Sectional views show construction features. Tables of dimensions are given. [Manufacturer: The Lunkenheimer Co., Box 360U, Cincinnati 14.]

Carbon Steel Specifications

HPAC 106—Chart on carbon steel specifications shows chemical analysis requirements for each of 60 military, Army, Navy, aeronautical and federal specifications. Also listed are specified forms, such as sheets and bars, and nearest corresponding SAE, AISI and AMS type numbers. Printed on cardboard, the chart is regular file card size. [Publisher: Peter A. Frasse and Co., Inc., 17 Grand St., New York 13.]

Centrifugal Pump

HPAC 107—Bulletin 211 describes the company's small close-coupled motor-driven centrifugal pump. According to the bulletin, Model "B" is made in two sizes, 1 in. and 1¼ in. discharge, and will pump up to 70 gpm with heads up to 110 ft. The pumps are designed for general service or as integral parts of air conditioning units, cooling towers, hot water circulators, etc. [Manufacturer: Carver Pump Co., Muscatine, Iowa.]

Channels and Fittings

HPAC 108—Catalog 153 gives initial basic information on the firm's line of channels and fittings including dimensioned drawings and engineering data. Tables on column load data and beam loading are included. [Manufacturer: Flexa Steel Products, Inc., 1348-50 W. Washington Blvd., Chicago 7.]

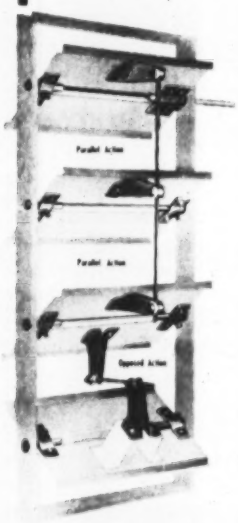
Chilling for Alloy Steel Heat Treatment

HPAC 109—Twelve-page brochure describes chilling for alloy steel heat treatment, metal stabilization, gas dehydration and parts and material testing. The various standard units for low temperature industrial and laboratory chilling are illustrated and described. [Manufacturer: Sub-Zero Products Co., Reading Rd. at Paddock, Cincinnati 29.]

Condensation Control Chart

HPAC 110—Four-page folder contains charts which are designed to show the exact degree of protection from condensation which is afforded by the company's Type "D" insulation. This insulation is a heavy spray applied coating to be used where a moderate amount of insulation is needed in conjunction with a corrosion preventive, such

Engineers · Manufacturers & Fabricators



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Specify and use the . . .

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PRECISION-ENGINEERED DAMPER HARDWARE

- **Produces highest quality damper.**
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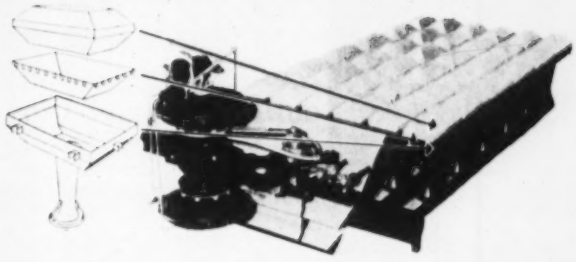

The UPSHOT TRULIRADIANT GAS BURNER **for vertical firing of steel firebox, cast iron and brickset boilers. An outstanding burner with specially designed refractory protection for burner heads insuring long life and providing maximum heat transfer to boiler surfaces for high efficiency.**

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compact, rugged for motor and Heater Circuits

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Proven performers in leading makes of window air conditioners, fans, blowers, unit heaters and similar equipment, "Diamond H" Series 240 Rotary Switches are available in 2, 3, 4 and 5 position models, with motor ratings and in a wide range of circuit variations and mounting arrangements.

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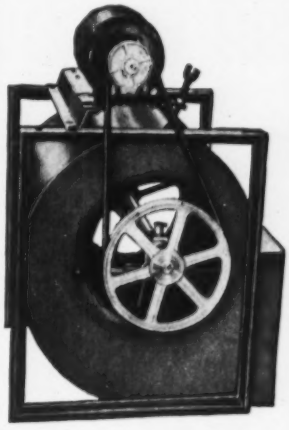

THE *NEW* UNIVERSAL TYPE "N" BLOWER

MASSACHUSETTS . .

By changing the position of the oil cup, the four popular discharges (lower horizontal, upper horizontal, down-blast and up-blast) can be obtained. Sizes 7 to 16½ inches wheel diameter.

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Air Cooling COILS
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NEW Complete Line
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4 Row Coils — for residential jobs.
6 Row Coils — for commercial jobs.

Precision built to insure top performance and to give trouble-free service.

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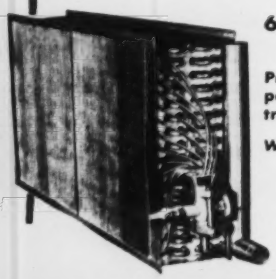
Complete facilities for fabrication of pipe coils — all types — all materials. Engineering service. Send details for price.



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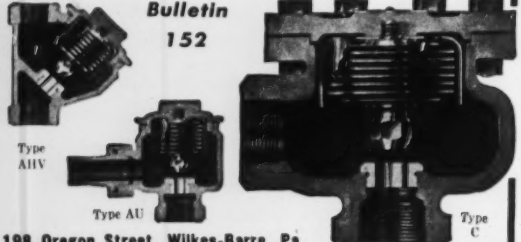
SAVE CAR OF COAL WEEKLY

Following replacement of all steam traps, of various makes, with Nicholson units, an Eastern college reports "an average coal saving of 1 carload per week besides much better heat distribution." Credit is given the higher and more even temperatures which Nicholson traps effect. See why large industrial and institutional steam users are increasingly standardizing on Nicholsons. 5 types; for heat, power, process; sizes ¼" to 2"; press. to 250 lbs.

Bulletin 152



198 Oregon Street, Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

as in heated storage tanks or the control of condensation on cold pipes and vessels. Through the use of the chart, it is said to be possible to tell to what degree the surface temperature will be raised after the insulation has been applied. Relative humidity, temperature of the equipment and of the ambient air also are taken in account in the charts. [Manufacturer: The Insul-Mastic Corp. of America, 1141 Oliver Bldg., Pittsburgh 22.]

Copper and Brass Products Literature

HPAC 111—File-size bulletin lists nearly 70 catalogs and technical handbooks on copper and brass products. Publications in the listing include descriptions of copper and copper engineering alloys; copper wire, cable and magnet wire; copper water tube and fittings; brass and copper building products, condenser and heat exchanger tubes, etc. The bulletin also lists available newspaper mats, data charts and radio scripts for the promotion of brass and copper products. [Publisher: Chase Brass & Copper Co., 236 Grand St., Waterbury 20, Conn.]

Corrosion Proof Tubing

HPAC 112—Bulletin L-6506 describes several different kinds of corrosion proof "Dekoron" tubing. This is metal or plastic tubing covered with a plastic sheath. The bulletin is illustrated with photographs of actual tubing installations. [Manufacturer: Samuel Moore & Co., Dekoron Tubing Div., Mantua, Ohio.]

Dial Indicators

HPAC 113—Bulletin 98214 describes the latest developments in 6 in. dial indicators for temperature, pressure and load applications. Information is included on features, dials and scales available, with reference material on the different types of actuation. For temperature instruments, a variety of sensitive elements or bulbs are explained and the recommended applications for each are shown. Mounting dimensions for the different types of instruments are also included. [Manufacturer: Taylor Instrument Companies, 95 Ames St., Rochester 1, N.Y.]

Diaphragm Motor Valves

HPAC 114—"Series 100" air-operated diaphragm motor valves are described and illustrated in specification sheet 419-2. The valve provides narrow-band proportional control at a minimum cost. The specification sheet also gives data such as size, construction, body pressure range, connections and complete mounting dimensions. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 64, Wayne and Windrim Aves., Philadelphia 44.]

Electric Heaters and Heating Devices

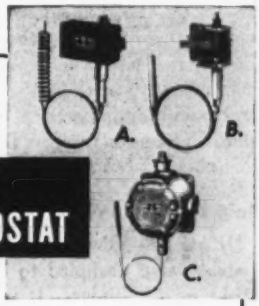
HPAC 115—GEC-1005D is a 60-page, two-color catalog on "Calrod" electric heaters and heating devices. An information and buying guide, it describes the equipment in terms of application, special features, installation and pricing. Indexed by process and application, the catalog also contains methods of determining power requirements and heat losses by applications. These are explained by graphs and formulas. [Manufacturer: General Electric Co., 1 River Rd., Schenectady 5, N.Y.]

Electronic Precipitator for Cleaning Air

HPAC 116—Bulletin 400 describes the "Electro-Stay-new" precipitator for cleaning air electronically. Accord-

A. TYPE E5

B. TYPE F42



AN ACCURATE ADAPTABLE THERMOSTAT

C. TYPE E98

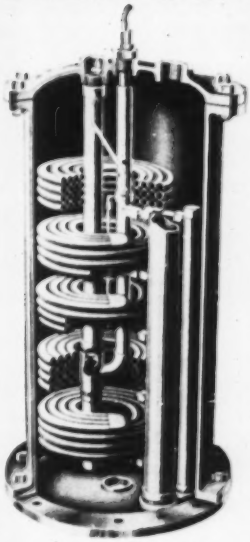
The type E5 thermostat is a precision-built temperature control which can be fitted with a wide variety of thermal assemblies and switches to suit the particular application. Temperature limits -150° F to +600° F.

The type E5 has been used on ovens, water baths, incubators, hot plate presses, cooling cabinets, air conditioning equipment, food and drink vending machines. Shown are three variations, the E5 covered by bulletin #3-2, Type F42 "skeleton" model covered by bulletin #3-3, and Type E98 in explosion-proof housing covered by bulletin #3-5. Write for information on the models of interest to you.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street, Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

AERCO COMPACT STORAGE WATER HEATER



Takes the place of large storage tanks under most conditions.

An abundant supply of hot water at even temperature under varying load conditions with low steam consumption and no surging of steamflow. The design allows the regulator to sense changes in quantity of incoming cold water BEFORE the water actually passes over the heating surfaces, thereby ANTICIPATING the new requirements of steam flow.

Write, wire or phone as to how you can effect substantial savings in cost.

- *Minimum storage volume* for peak demands.
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- *Accurate* controlled outlet water temperature under *all* load conditions.

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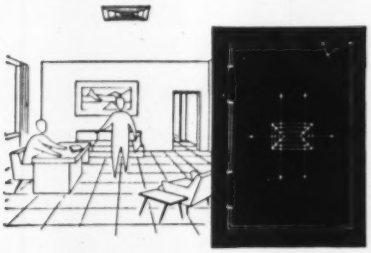
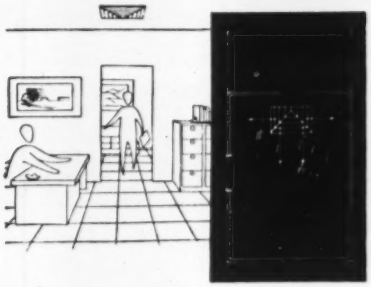
How to be years ahead . . . overhead!



Today, AGITAIR RC, with 4-way core, provides correct air distribution from room center.



Tomorrow, with walls moved and partitions added, a 3-way AGITAIR core assures correct air distribution from side of room.

The vanes make the difference

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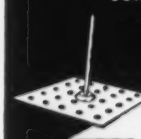

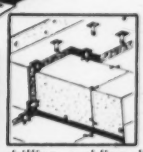

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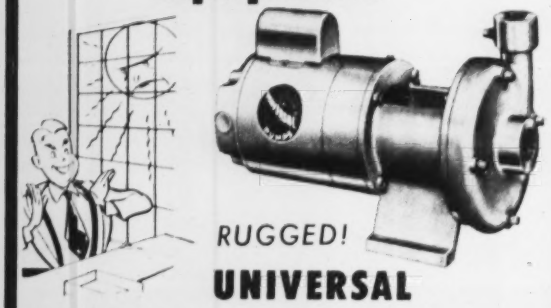

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- Series WXH Low Priced
- Highest quality construction
- Motor—standard make, 3450 RPM
- Shaft Seal—mechanical cartridge type or stuffing box
- Shaft—Precision ground . . . smooth, quiet operation
- Impeller—all bronze, fully enclosed
- Suction—single stage end suction units

Available from ¼ HP through 5 HP . . . designed for efficient, dependable operation . . . ideal for air conditioning, with large capacities at moderate heads. Write for descriptive circular.

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Butterfly VALVES

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Made of any metal or rubber lined, in all standard pipe sizes to 72" and in special fabricated types for round or rectangular ducts, piping and equipment; pressure to 600 p.s.i. Flanged or threaded. Manual or automatic controls. Easy to operate and clean. Quick regulating and closing.

Rockwell valves also made in slide types in sizes to 24".

Get Rockwell Valve Catalog and ask to receive Rockwell Valve News monthly.

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ing to the bulletin, dust particles are charged as they enter the unit. The particles are then attracted to and held by the negatively charged collector plates. Construction features are shown in detail. Also included are the mechanical and electrical specifications and a selection table. [Manufacturer: Dollinger Corp., 11 Centre Pk., Rochester 3, N.Y.]

Flow Control Valve

HPAC 117—Two-page bulletin No. 4810 describes a flow control valve designed to control the speed of the piston stroke in a cylinder. It is available in six standard pipe sizes from ¼ in. to 1¼ in. [Manufacturer: Airmatic Valve, Inc., 7317 Associate Ave., Cleveland 9.]

Flow Meters

HPAC 118—A set of seven new specification sheets in consolidated style covers the company's flow meter line. Specification sheets 211 and 212 cover electric and mechanical evenly graduated flow meters, respectively. Specification sheets 213 through 217 cover square root flow meters and liquid level meters. Construction and engineering details are included. [Manufacturer: Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.]

Gas Boilers for Larger Buildings

HPAC 119—Catalog 607 illustrates and describes the company's "Series 66" gas boilers for heating in the larger residential, institutional, commercial and industrial applications. The brochure shows the automatic controls furnished with these boilers and includes drawings of control systems for both hot water and steam installations. Tables are given covering boiler horsepower, I-B-R ratings and AGA input and output ratings for natural, mixed, manufactured and LP gases. Other information includes roughing-in measurements and dimensional data on tappings, flue openings, gas lines and chimney sizes. [Manufacturer: National Radiator Co., 221 Central Ave., Johnstown, Pa.]

Gear Drive for Turbine Pumps

HPAC 120—Bulletin describes the "Holloshaft" gear drive used to operate vertical turbine pumps where electricity is not available. Cut-away illustrations show construction features such as dual sight lubrication and a keyed shaft which accommodates any type of pulley or which can be directly connected to gas, gasoline or diesel engines through a double universal joint or coupling. [Manufacturer: U.S. Electrical Motors, Inc., P.O. Box 2058, Los Angeles 54.]

Hermetic Refrigeration Units

HPAC 121—A bulletin on "Supermetic" power units for commercial refrigeration and air conditioning applications discusses typical applications, gives specification and capacity tables for the various sized units. These units, which are hermetic motor-compressor assemblies, are manufactured in low, medium and high temperature models. [Manufacturer: Servel, Inc., Electric Refrigeration Div., Evansville 20, Ind.]

Industrial Temperature Control

HPAC 122—The basic principles of industrial temperature control are discussed in a revised edition of *The De-*

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ALL STEEL REGISTERS for walls or ceilings

HERE'S WHY:

Auer Fig. K Steel Register

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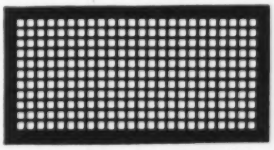
Auer Fig. KP Pulley-Operated Register



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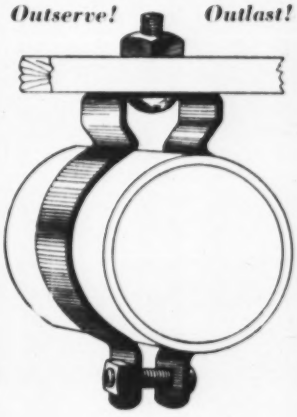

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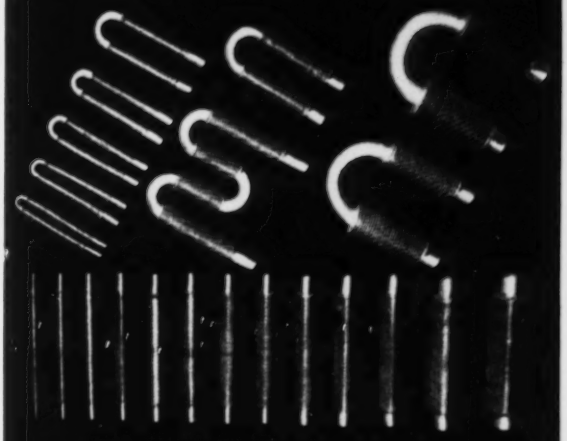

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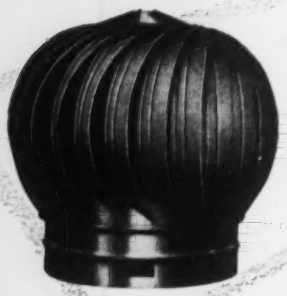

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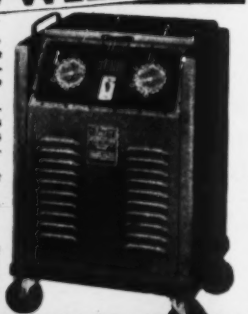

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sign and Process Engineers Guide to Industrial Temperature Measurement and Control. Some of the subjects covered are the influence of the firing system upon design of the control system, fundamental principles of mercury-bulb installation and the basic concepts of electrical and mechanical control theory. Typical control circuits and piping system arrangements, as well as the ranges and calibrations of scales and dials, are presented diagrammatically. [Manufacturer: The Partlow Corp., New Hartford, N.Y.]

Piping Insulation

HPAC 123—A complete description of the firm's product, "Ultralite," is presented in this booklet. This material is a glass fiber insulation for hot and cold piping insulation. One section of the booklet describes its composition, physical properies, limitations and technical information. A second section contains descriptions and on-the-job photographs showing application procedures step by step. [Manufacturer: Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City, Mo.]

Pneumatic Receivers for Controllers

HPAC 124—Specification sheet 285 describes pneumatic receivers which are furnished as indicating controllers, recorders and recording controllers. Photographs of various models and construction and engineering details are included. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 64, Wayne and Windrim Ave., Philadelphia 44.]

Recorder Controller

HPAC 125—Bulletin 465 illustrates and describes the company's restyled "Circular Case Controller," which is designed to automatically control temperature, pressure, liquid level, humidity and other process variables. Showing typical applications in industry, the bulletin discusses each unit of a pneumatic control system. A section of installation diagrams and text is devoted to on-off and proportional control. A two-page data section analyzes the four classes of measuring systems available for automatic temperature control. [Manufacturer: The Foxboro Co., 106 Neponset Ave., Foxboro, Mass.]

Rubber Putty

HPAC 126—Specification sheet 9765 describes "Plastikon" rubber putty for glazing and sealing of wood, glass, metal and stone. According to the manufacturer, the rubber base putty has permanent pliability, withstands vibrations, expansion and contraction and high and low temperatures. In addition it is designed to resist corrosive fumes, salt water and mild organic vapors. When used in refrigerated cold cabinets, it remains pliable, the manufacturer states. Illustrations of typical installations are shown in the bulletin. [Manufacturer: B. F. Goodrich Co., 548 S. Main St., Akron 18, Ohio.]

Sheave and Hub Data

HPAC 127—Specification guide 83 gives dimensions and weights of "QD" V-belt sheaves and hubs. Construction features are described by cut-away photographs and installation and removal instructions are illustrated by pictorial panels. Tables and line drawings give complete hub and sheave dimensions including face width, hub position, hub length, minimum and maximum bore, as well as

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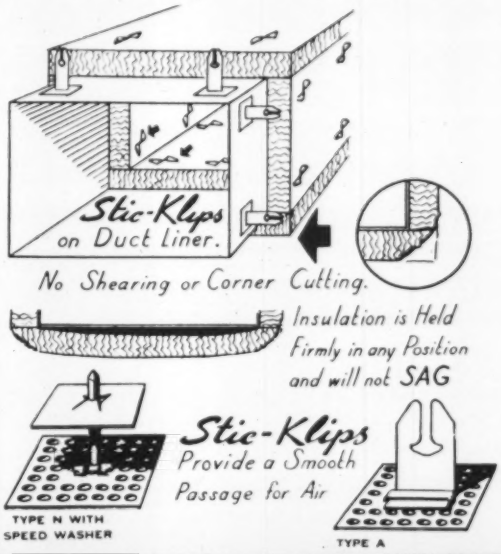

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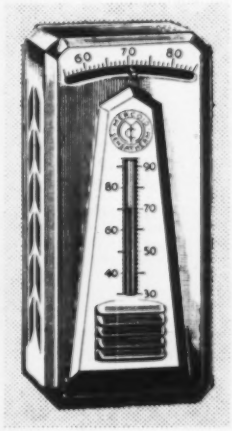

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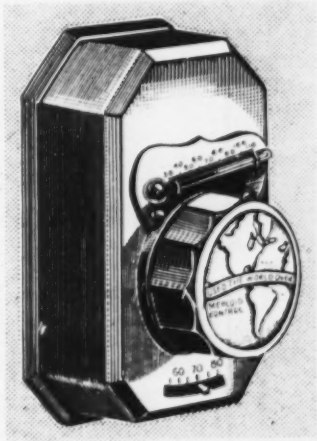

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dimensions of standard keyway. [Manufacturer: Fort Worth Steel & Machinery Co., P.O. Box 1038, Fort Worth, Texas.]

Temperature Regulators for Liquids, Steam, Gases

HPAC 128—Bulletin ST162 describes "Series V" self-operating temperature regulators for liquids, steam or gases. Included are a discussion of the principles of operation, a cut-away diagram showing construction features, tables of dimensions of the various models and a selection table. [Manufacturer: Farris Stacon Corp., 563 Commerical Ave., Palisades Park, N.J.]

Test Report on Insulated Pipe

HPAC 129—This is a six-page report on simulated operating tests made on the company's insulated pipe. The bulletin contains details on methods, temperature recordings and results of recent tests made by an independent engineering firm to determine temperatures developed in and near conduit buried 48 in. underground and to determine the effects of water and high temperature on the casing. [Manufacturer: Durant Insulated Pipe Co., Western Div., Palo Alto, Calif.; Durant International Corp., Eastern Div., Williamstown, N.J.]

Thermistor Data Book

HPAC 130—A 36-page booklet describes thermistors, including gas analysis cells, combustion analyzers, temperature-sensing devices and electronic and thermal control instruments. Included is data on the types of construction, operating characteristics and applications of thermistors. [Manufacturer: Victory Engineering Corp., Springfield Rd., Union, N.J.]

V-Belt Packaged Fan

HPAC 131—Catalog 515 describes the new V-belt driven packaged fan, the "Ready Unit." These units are recommended for ventilation in industrial plants, commercial and public buildings and can be installed indoors or out-of-doors. Specially built units can be furnished for handling corrosive gases. Construction features are shown in the booklet and complete capacities are given for each size of unit. [Manufacturer: Clarage Fan Co., Porter St., Kalamazoo 16, Mich.]

Water Heaters and Coolers

HPAC 132—Eight-page brochure consists of illustrations and line drawings covering a wide variety of the firm's line of water heaters and coolers. Accompanying diagrams on every page show how each individual unit functions. Also included are various tables dealing with heater selection, sizes, capacities, dimensions, etc., which tell how to select a heater or converter depending on the technical conditions to be met. The brochure is designed as a reference folder for technical information. [Manufacturer: Manning & Lewis Engineering Co., 28-42 Ogden St., Newark, N.J.]

Welding Accessories

HPAC 133—Welding accessories catalog offers a method of package buying to speed up delivery time. According to Warren Ware, specialty sales manager, items ordered from the 16-page catalog are shipped the same day the order is received. [Manufacturer: A. O. Smith Corp., Welding Div., 3533 N. 27th St., Milwaukee 1.]

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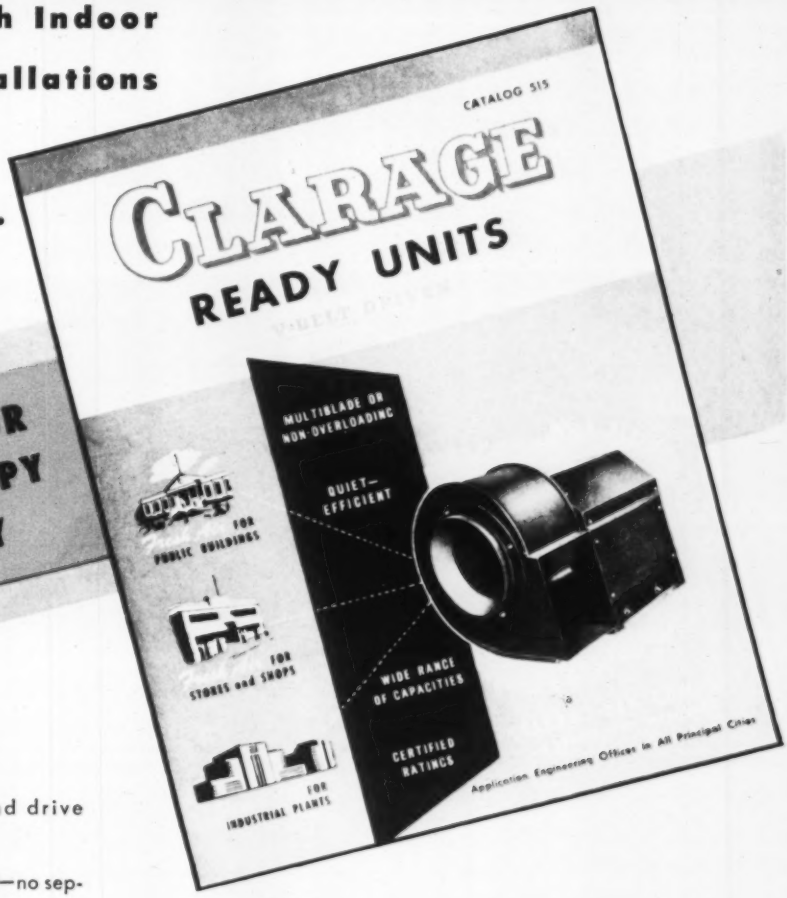

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January 7, 1953

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3500 N. Spaulding Ave.
Chicago 18, Ill.

Attention: Mr. N. W. Swanson.

Dear Swanie:

Yes, we are still accumulating the by-products (shipping plugs from your water feeders) mentioned in my letter of July 30, 1940, only more so.

Since 1940 the number of mechanically fired jobs has steadily increased so that a large majority of your feeders are now installed with a No. 2 low water fuel cut-off switch. Consequently our shop gets littered up with the tin cover plates taken off where the No. 2 switch is mounted.

Jim, our shopman, takes care of the situation by having two containers conveniently placed in the shop, one marked "Shipping Plugs" and the other "Tin Cover Plates". When they are full, our serviceman turns them over to your genial Mr. Spink.

The above system is also handy for me: When I want to see how our profitable water feeder business is doing, all I have to do is just look at these two containers and when they get full, we declare a dividend.

Happy New Year to you and the McD & M Crowd.

Sincerely yours,

J. P. BALDWIN CO.

BY J. P. Baldwin

JPB:em

When you fill up enough, so do we. Good news!

We showed this in an ad. Remember?

He's been called other things too!

Joe Thanks for your kind words. Swanie

The new McDonnell Condensed Catalog has all the facts on these feeders and cut-offs. If you don't have a copy handy write today. Ask for sample mailing circulars too.